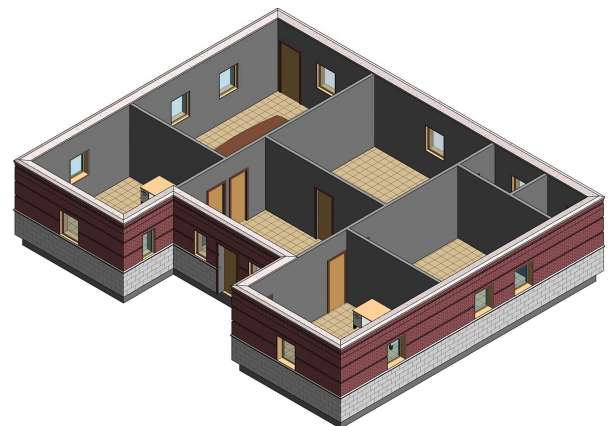
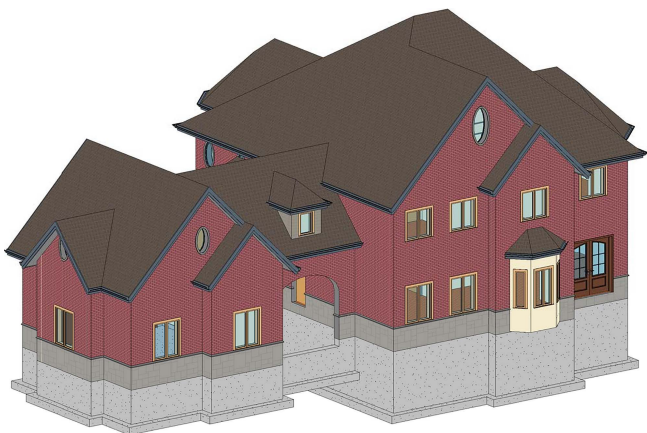


Revit Architecture 1



Modeled and Rendered in Revit Architecture



Revit Architecture Level One – Assignment Overview:

1. Assignment #1 – The first assignment covers all material in the first 6 lessons
 - a. Create all 8 sheets as shown in the handouts at the end of Lesson 6.
 - b. Add dimensions to plans as shown on handouts.
 - c. Ensure all annotations read clearly. Jog elevation lines where required.
 - d. Ensure all views are set to medium detail and "shaded" view style.
 - e. Add view titles and fill out title blocks.

2. Assignment # 2 – The second assignment covers all from lesson 7 to lesson 12.
 - a. Create all 12 sheets as shown in the handouts at the end of lesson 12.
 - b. Ensure all views are set to medium detail and "shaded" view style.
 - c. Add dimensions as shown on the finished set of handouts.
 - d. Ensure all annotations read clearly. Jog elevation lines where required. Adjust positions of section line heads. Roof Slopes and general notes are NOT required.

AGENDA:

1. Introduction to BIM Concepts
2. Introduction to Revit Concepts
3. Exploring the Parts of the Revit Interface
4. Revit Interface Basics

1. Introduction to BIM Concepts

BIM or Building Information Modeling is a new and revolutionary approach to the design and documentation of buildings. BIM allows you to manage the information related to a building through the entire life of the building design, from early conceptual designs, through to detailed construction documentation, and even beyond the construction phase to facilities management throughout the life of the actual building.

The “information” in Building Information Modeling refers to all of the input that goes into the building design including things like materials, wall construction, the number and type of doors, floor areas and usage patterns, energy analysis, quantity takeoffs and even cost estimates. All of this information is contained in an intelligent 3-dimensional model of the building that can be viewed in a variety of ways and outputted to fully coordinated construction documents.

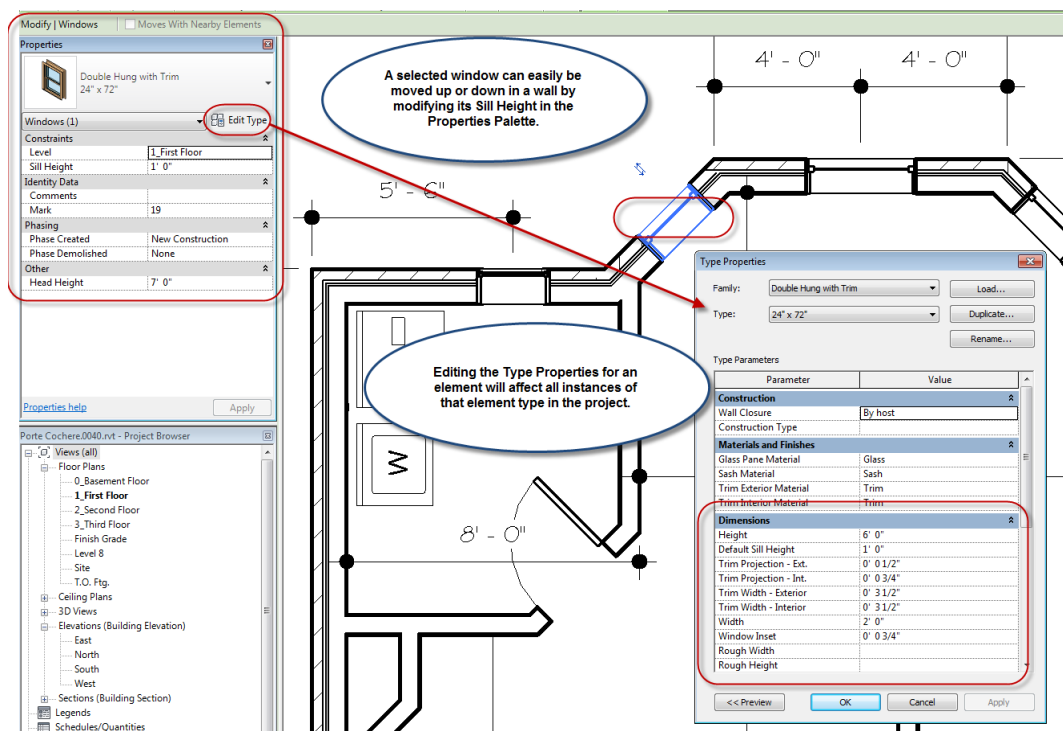
There are many advantages to working with a BIM approach. Probably the most significant benefit is that developing a single building model as the basis for all related construction documents ensures coordination between different views of a model. When you delete a window in a plan view, this change will automatically be applied to the elevation view. The window schedule will also be updated at the same time. Any changes made to the model, in any of its views will seamlessly and automatically be propagated to all other related views.

Other benefits to working within a BIM approach include: a better understanding of the building and its spaces by being able to easily view the model in 3D, fewer errors in cross-referencing views and details, interference checking for conflicts among various structural, mechanical and architectural elements, automated schedules, and quantity takeoffs.

2. Introduction to Revit Concepts

Revit is the newest and most technologically advanced BIM application currently available. Revit software now encompasses the full spectrum of industries required to bring a building design to fruition with support for Architectural, Structural, and MEP, (mechanical, electrical, plumbing) disciplines.

Revit was designed from the ground up specifically to address the requirements of the BIM industry development. The name Revit was derived by the original developers from the term “Revise Instantly” and from the beginning, this platform was designed to be able to manage changes in the design of a building.

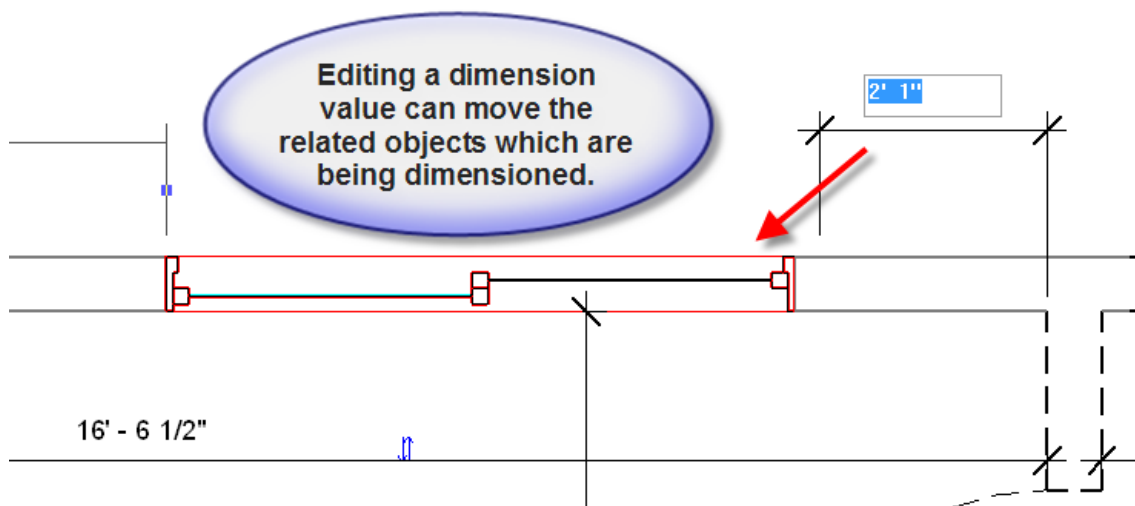


Revit uses Parametric Objects and Parametric Relationships to help accommodate the inevitable changes that need to be executed when developing a model. A parametric object is an intelligent object that can have various sizes, materials, or other parameters assigned to it. These parameters can be accessed and modified through a dialog box allowing you to quickly and easily create variations on a single object. A desk could have parameters such as length and width that could easily be modified without affecting the height of the object.

Parametric objects are a common feature in many modern software packages but Revit extends the power of parametrics by allowing you to create intelligent relationships between objects. A floor, for example can be attached to a set of walls which encompass the floor. When you move a wall to resize the structure, the floor will also automatically resize to follow the new shape of the surrounding walls.

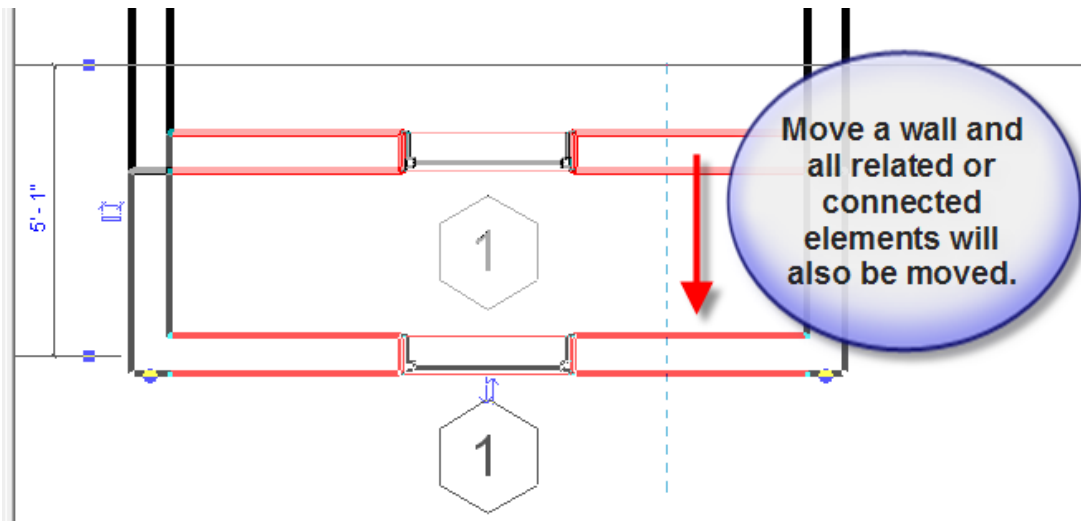
Many elements such as walls, floors, roofs, etc. are constrained to levels or critical heights defined in your building such as the height of the floor above grade and the height of the ceiling above the floor. If you change the floor to ceiling height by moving one of the levels, all elements that are related to that level will automatically be adjusted.

In a regular CAD drawing, changing the position of an element such as a window by stretching it, will also update any associated dimensions. In Revit, this is also true, but it is taken a step further as you can select any dimensioned element such as a door or wall, and its dimension values will be highlighted. Modifying the dimension value will actually modify the position or size of the dimensioned element. Dimensions are not only associative as in regular CAD, but are truly parametric, being able to drive the design.



Annotation and Sheet management is also fully parametric in Revit. Tags and detail notes are linked to objects and to the sheets on which views are placed. If you change a sheet number, all details on that sheet will automatically be renamed and renumbered in all other related views.

Revit creates logical relationships between elements such as connected walls or windows within a wall. If you delete a wall, any elements hosted by that wall such as doors or windows will automatically be deleted as well. If you move a wall by picking and dragging it, not only will its hosted elements such as doors and windows move with the wall, but any other walls which are connected to the wall being moved will also be resized to maintain the connections or Joins between those wall.



Additional User-Defined rules may also be created to maintain dimensions or relationships between elements in your model. For example you might wish to define a window as being placed in the middle of a gable wall. If the wall changes width, the window will automatically be moved to maintain the Equal distance of wall on either side. This can be accomplished with an Equal dimension constraint.

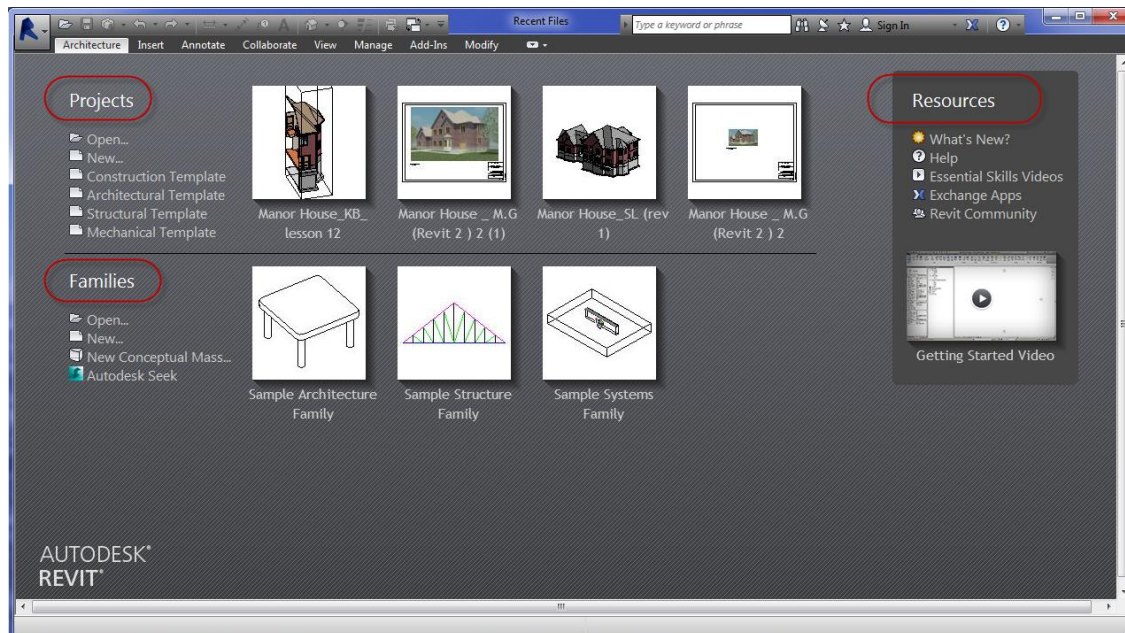
Objects may be locked to other objects with alignment Padlock constraints. For example, one edge of a stair may be locked to a wall such that if you move the wall, the stair will be moved along with it or vice versa. Elements may also be locked to prevent unintended edits.

It is worth noting that although it is easy to create constraints between elements and lock them together, it is recommended to keep the number of constraints and locks to a minimum. Consider locks and constraints to be a temporary measure to aid in the design process. Add the constraint or lock but then remove it after the elements have been positioned correctly.

Too many constraints can make a project difficult to edit and will increase file sizes dramatically.

3. Exploring the Parts of the Revit Interface

When you first open Revit, a Recent Files window will appear with three main sections – Projects, Families, and Resources.

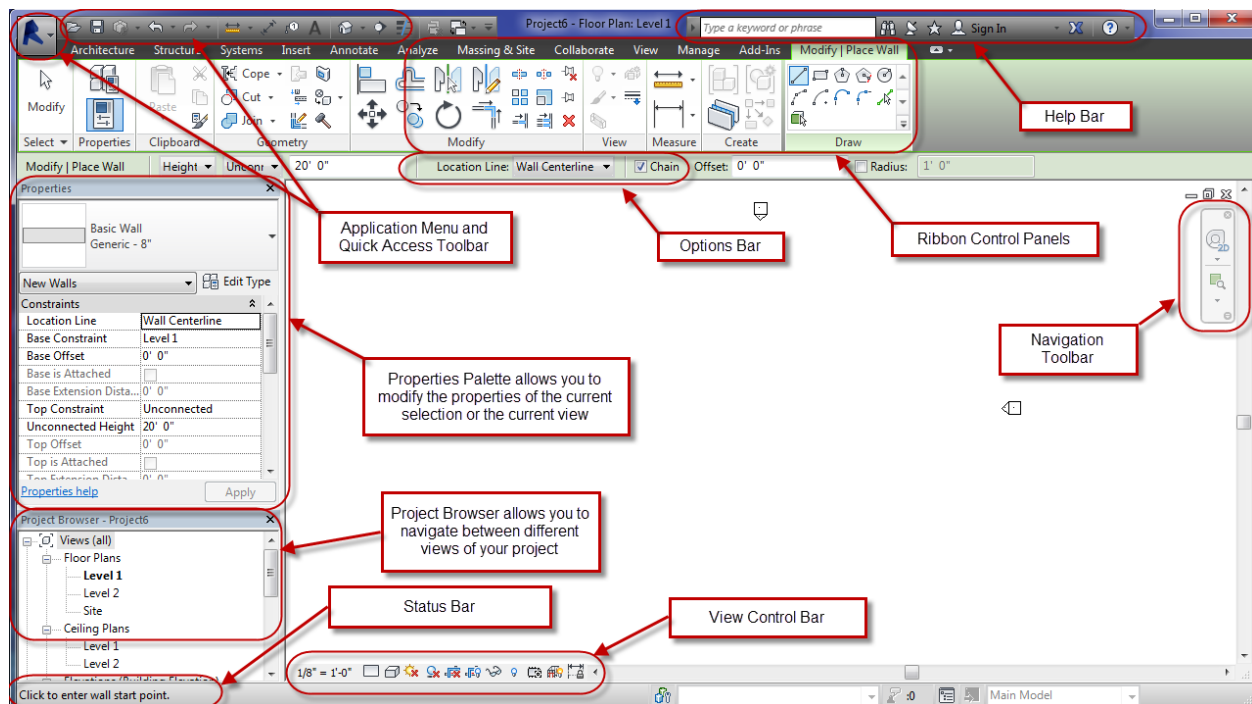


Projects are the main file type and format for working in Revit. The Projects section shows the four most recently accessed project files with thumbnail images for each. There are Open and New links as well as links to the four main project template files for different disciplines – Construction, Architectural, Structural, and Mechanical.

Different templates will contain numerous settings such as starting views, measurement settings, and project phasing as well as preloaded content. In this course, you should start your projects with the Architectural template. This will use the “Default.rte” template from the US Imperial templates folder.

If you pick New, you will be shown a dialog box with a browse option that will allow you to find any template file including those with a different system of measurement. When you install Revit, the initial templates and measurement system are assigned based on your location. You can modify this information by accessing the Content library options in your Windows Control Panel.

When you start a new project in Revit you will see an interface with a large drawing area and several areas for accessing commands, setting options and parameters, and controlling the view of your drawing or model.



It is possible to modify the appearance of the interface by opening or closing interface elements via the User Interface pulldown on the Windows panel of the Ribbon's View tab. You may drag the Project Browser or Element Properties palettes to a new position or float them in front of the drawing area. You may also toggle the display of the Ribbon control panels by selecting the minimize options at the right side of the tabs.

The Structure and Systems tabs on the Ribbon may be turned off when working with the Architectural portion of a project by accessing the User Interface section of the Options dialog.

Revit has excellent support for keyboard shortcuts which are widely used to speed access to commonly used commands. The tooltips display the 2-key shortcut for all commands that have shortcuts defined. Example – Wall = WA and Door = DR.. Type KS to open the keyboard shortcuts dialog box where you can view, create, and modify all shortcuts.

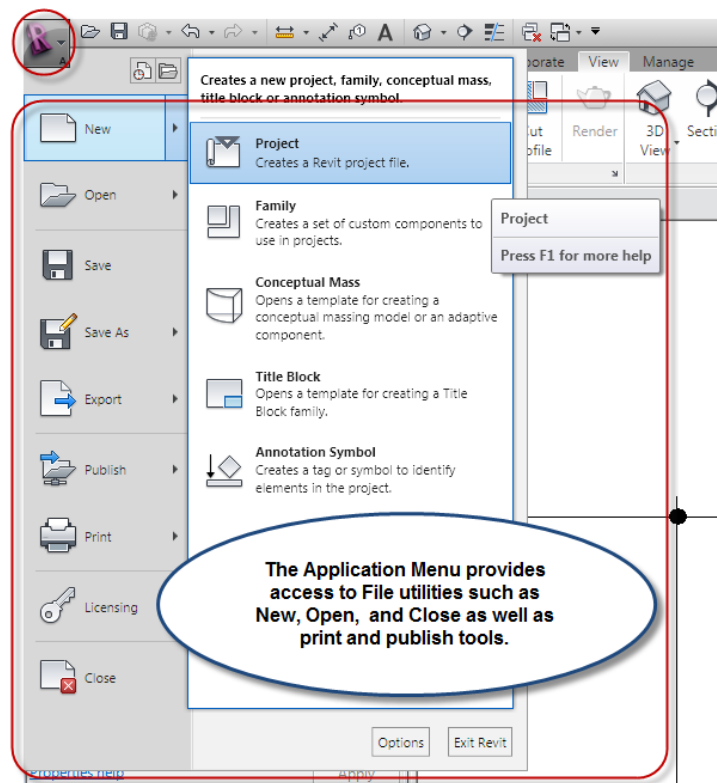
Title Bar

The title bar at the top of the screen displays the version of software, the name of the current project and also the current view name. At the right end of the title bar you will find a set of help options including a search field which allows you to type in a search query for any topic.

Application Menu

The Application Menu is accessed by selecting the large letter R in the upper left corner of the screen. This dropdown menu allows you to start new files, open existing files, close files, export the current project, print or publish the project, and access program options and license information.

Pick Options from the Application menu to open the main options dialog for Revit. The options dialog has sections for specifying the default file locations, save reminder intervals, view and navigation behaviors, spellchecking options and much more.

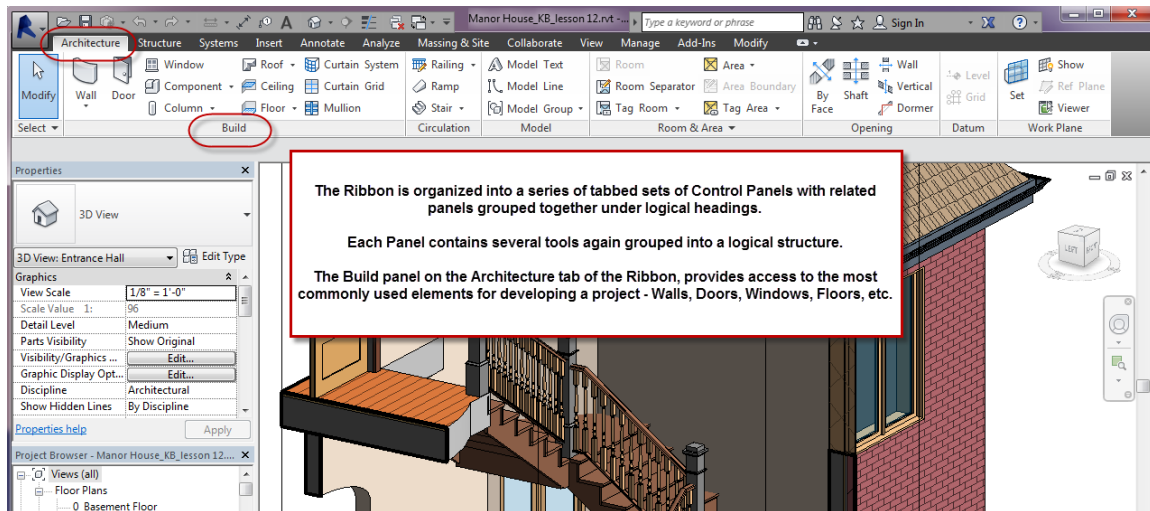


Quick Access Toolbar

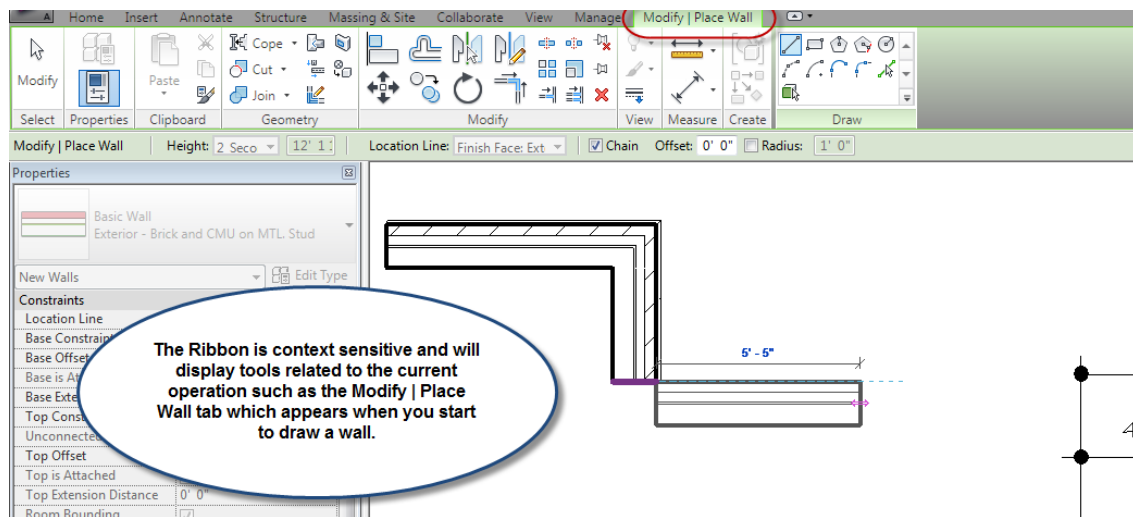
The Quick Access toolbar located to the right of the Application menu provides access to many of the most commonly used commands such as Undo and Redo, File utilities, Dimension tools, Text tools, and 3D viewing options. The Quick Access toolbar is easily modified by selecting elements to include on the toolbar from a dropdown list accessed via the arrow pulldown at the right end of the toolbar.

Ribbon Control Panels

The Ribbon is the main interface element used for accessing tools in current versions of Revit. The Ribbon contains 9-12 default tabs and each tab has a corresponding set of control panels which may be displayed by picking that tab and setting it current.



The Ribbon is a context sensitive interface element and its contents will vary with the currently selected tool or element. If you select a Door tool from the Build panel on the Home tab of the Ribbon, a new tab will appear called "Modify | Place Door". These context sensitive tabs also appear when you select an existing element so if you pick an existing window, a tab will appear called "Modify Window".

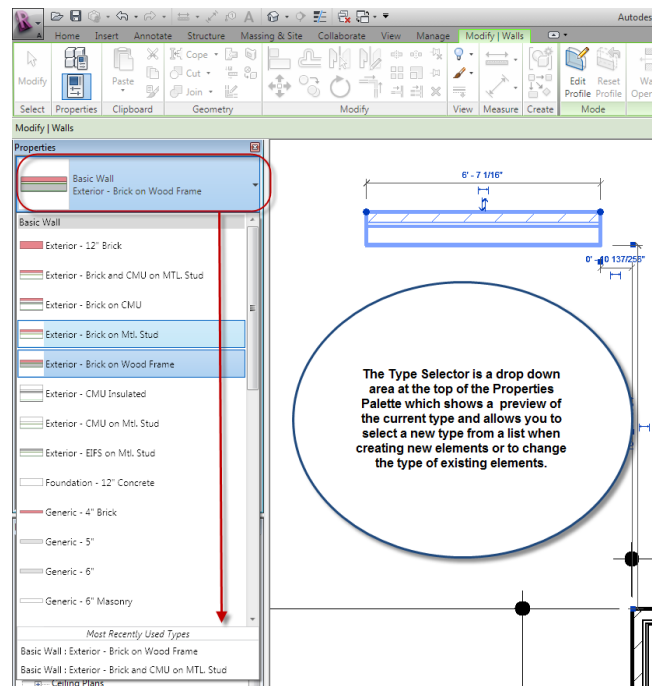


Type Selector

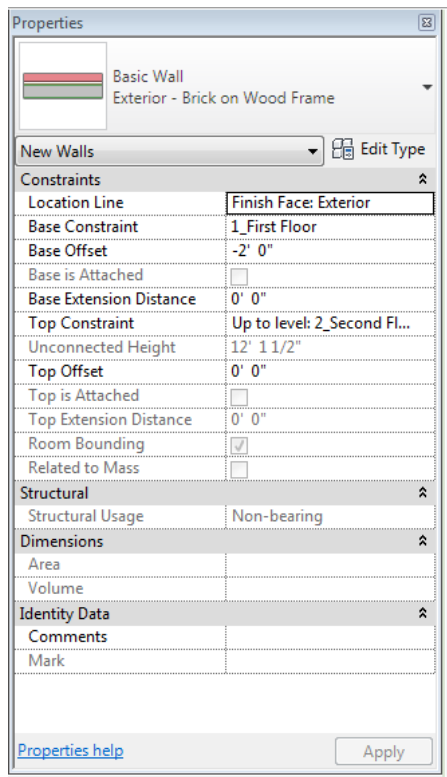
The Type Selector is a dropdown list of available variations for an element. The content will vary with the selected element.

If you select any element in Revit, its specific type will be displayed in the Type Selector window.

The Type Selector may be used to set the type for an element when it is being created or to change the type for one or more selected elements.



Properties Palette



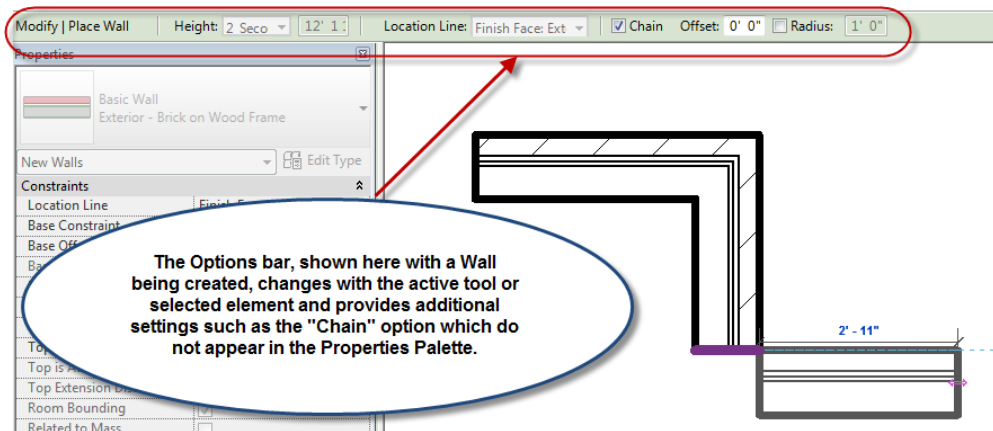
The Properties palette is one of the most important interface elements. It allows you to set all instance parameters for any object as it is being created. Pick any object creation tool, pick the element type, set the element properties, and then continue to create the element.

The Properties Palette also allows you to modify the properties for a selection set of existing objects. The Properties palette is context sensitive and will display only settings and parameters which are applicable to the object being created or which are common to the current selection set.

The Properties palette displays the settings for the current view such as scale, detail level, etc. when no objects are selected and no object creation tool is active.

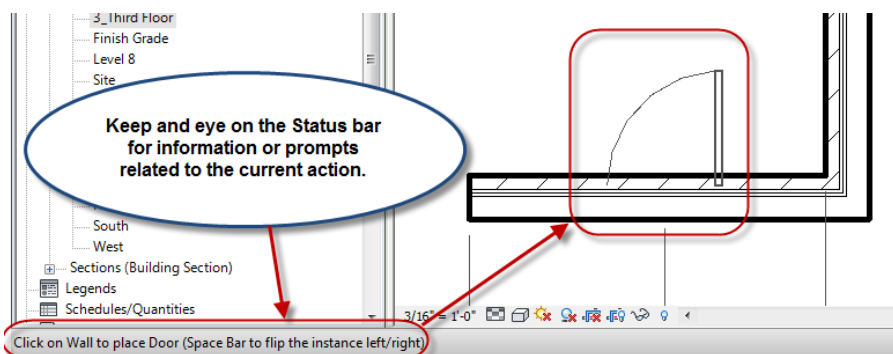
Options Bar

The Options Bar will change dynamically depending on the type of element which is selected or is being created. It allows you to change the behavior of the object creation and/ or the parameters for the object.



Status Bar

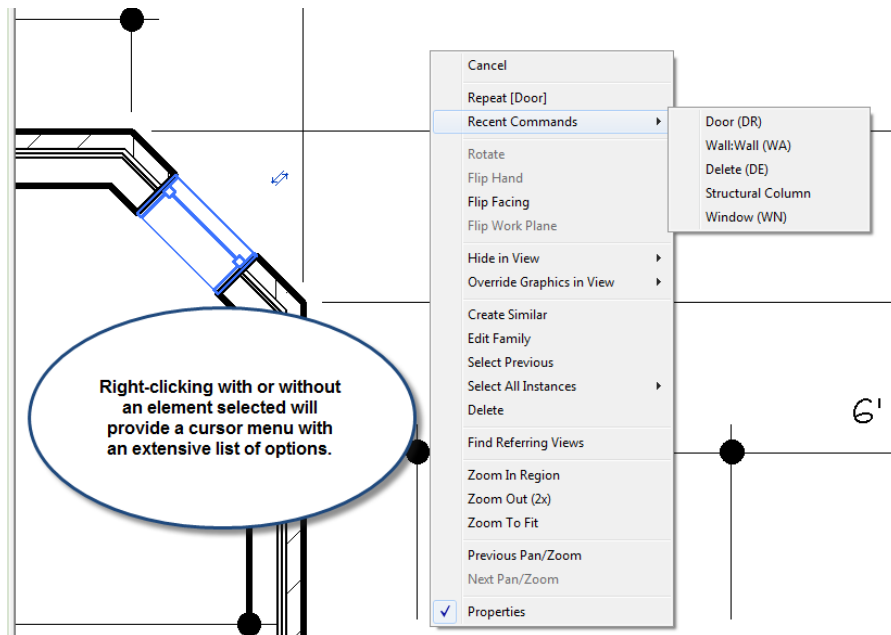
The Status Bar at the bottom of the application window will display information relevant to the current command or operation and is similar to the command window in AutoCAD. Start a wall, and the status bar will prompt you to pick a start point. Start a door command and the status bar will prompt you to select a wall to which you will add the door.



If you mouse over an element in the drawing area such as a door or wall, it will show a description of the element type. This will also work with one or more objects in the active selection set.

Shortcut Menus

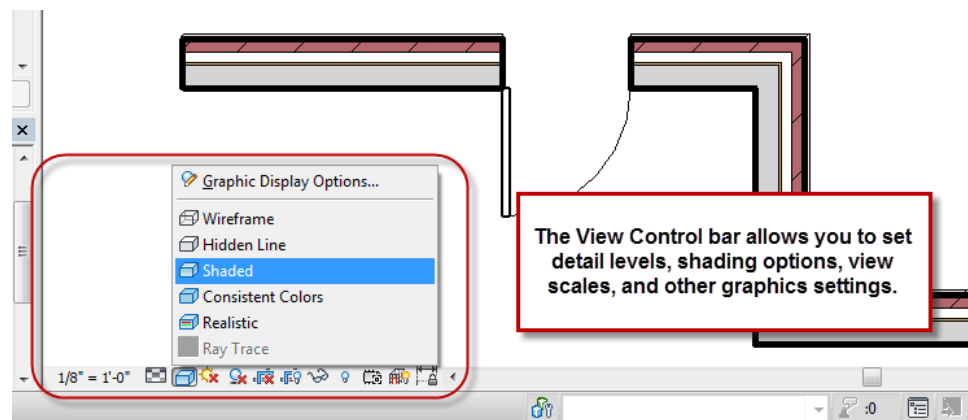
Right clicking in the drawing area or over a selected element will provide quick access to many common commands that are applicable to the current selection.



The cursor menu also provides access to zoom and pan commands, options to create a duplicate of a selected element, and to a list of recent commands.

View Control Bar

The View Control Bar just above the Status Bar provides access to several common functions that will modify the appearance of the contents of the drawing area.



Project Browser

The Project Browser shows a logical hierarchy of all Views, Legends, Schedules, Sheets, Families, Groups, and linked Revit models for the current project.

The major categories above can be expanded or collapsed by selecting the arrow by the category name.

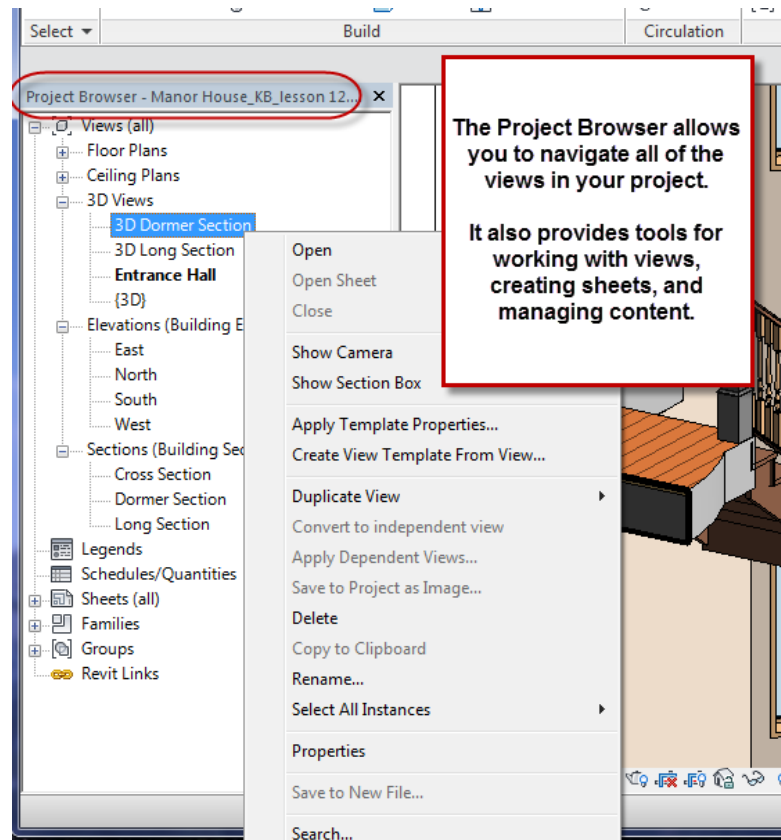
Selecting an entry in the Project Browser and then right-clicking will display a context sensitive set of commands or options which you can apply to that selection.

To select more than one object in the browser at the same time, use the standard Windows selection functions by pressing and holding the CTRL or SHIFT keys while picking entries.

The most common use for the Project Browser, especially for the beginning user, is to use the View category to switch between views. To make a view active, you can either right-click over the view and choose Open, or simply Double-click the view name to bring it to the front and set it as the active view.

Each time you open a view, it remains open when you switch to another view. All open views are listed in the Switch Windows pulldown menu on the Quick Access toolbar and it is a good idea to periodically check this list to ensure you don't have too many windows open at one time.

Other common view options include Renaming, Deleting, and Duplicating Views, all of which can be accomplished from the context menu.



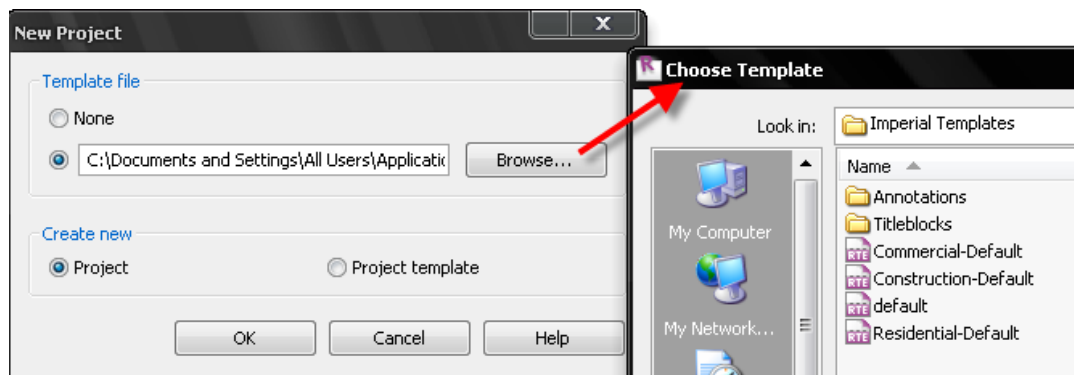
4. Working with the Revit Interface Basics

Starting a New Project

A Project is the database of information for your design or Building Information Model. The project file contains all of the information required to describe and document your building. As the design progresses you will create as many views as are required to document the design. When you make a change in any view, all related views will update.

When you first start Revit, the recent files window will appear, showing you the four most recent projects you have worked on. You may open one of these files or you can pick the Open button at the left side find another project to open.

To create a new Project, choose the *New* button at the left side of the Recent files list or from the application menu, choose *New / Project*. The latter method will open the New Project dialog where you can select your desired template. Revit includes several template projects for different systems of measure and also for different uses such as Residential or Commercial. Selecting the Browse button allows you to find the correct template for your intended design.



If you start a new project by choosing the New Project tool icon on the quick access toolbar, Revit will also display the New Project dialog box shown above.

Selecting the None option will allow you to start a file with either metric or imperial units, no component families loaded and only a single Floor Plan and Ceiling Plan for views.

Element Creation Basics

Buildings are created by adding elements. There are three distinct types of elements in Revit: *Model Elements, Datum Elements and View Specific Elements.*

Model Elements

Model Elements are all of the physical components that define the building including walls, floors, roofs, doors, etc. There are two types of Model elements – *Host Elements* include all of the major building components which are usually constructed on site. *Model components* are all of the other types of elements in the building model which are usually brought in and installed such as Doors, Windows, Plumbing Fixtures, etc.

Datum Elements

Datum elements define the context and critical locations for the building project and include Grids, Levels and Reference Planes.

View Specific Elements

View Specific elements only appear in the views in which they are placed. They serve to describe and document the model and include things like Dimensions, Tags, and Notes. There are two types of view-specific elements – Annotation elements such as dimensions and keynotes; and Detail elements such as lines, filled regions, and 2D detail components which provide more detail about a particular area in the building.

To create an object in Revit, choose the element category from the Ribbon or quick access toolbar, select the element type in the Type Selector, choose appropriate options on the Options bar, and then select points or host elements in the drawing area.

Some objects must be hosted and cannot be placed directly in the drawing. For example a door cannot exist as a free standing element and must be placed in a wall. The Status bar will always display information regarding the object being created and what Revit is expecting from you.

Entering Coordinates and Temporary Dimensions

When drawing lines or walls, special dimensions will appear showing you the current length of the element being created. If you type a value and hit enter, the line or wall will be drawn that length. If you are working in metric, the number you type will be in millimeters. If you are working in Imperial system and are using Feet and Inches, the number will represent Feet, not inches. To enter feet and inches, you can use the ' symbol to represent Feet and the " symbol to represent inches. You can also use a space between two numbers to represent feet and inches. A second space after the inches would allow you to also include a fraction.

1. Example 1 – To enter 48 feet and 8 inches you could type either **48'8** or **48 8**
2. Example 2 – To enter 9 and one half inches you could type **0'9 ½** or **0 9 ½**
3. Example 3 – To enter 6 inches you would type **0 6** or **6"**

When adding model components or when you select existing components, Revit will display temporary dimensions around the components, allowing you to easily position the component in the correct place relative to surrounding elements.

Temporary dimensions are placed in accordance with the settings defined in the Temporary Dimension Properties dialog. (Additional Settings pulldown on Manage tab of the Ribbon). These settings determine whether a temporary dimension will be drawn to the centre of an object or to one side of the object.

To move a temporary dimension's witness line, you can pick the blue box on the extension line or right click the blue box and choose Move Witness Line.

Use temporary dimensions to move objects into the correct position, by selecting the element, modifying the witness lines if necessary, and then picking the blue text to edit the value as required.

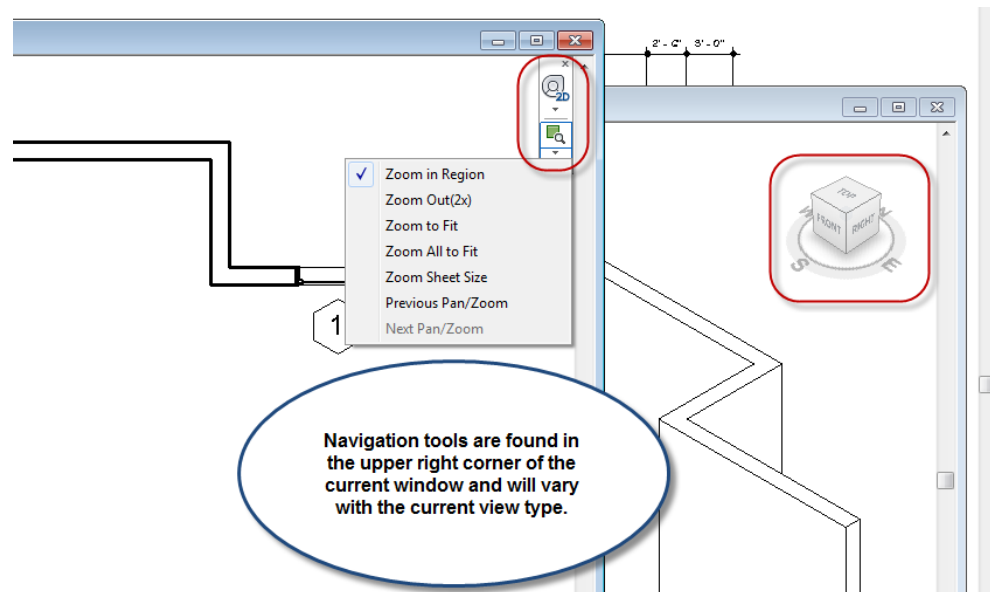
By default, temporary dimensions are only shown for the last selected object. It is possible to display temporary dims for multiple objects by selecting them and then choosing Activate Dimensions from the Options Bar. Note that displaying multiple sets of temporary dimensions at one time can decrease software performance.

Navigation

Navigation techniques within the Revit drawing area are similar to those found in other Autodesk applications. The fastest way to enlarge or reduce the size of the current view is to use the wheel on your mouse. Move the cursor over the area you wish to zoom on and turn the wheel forward to zoom in and backward to zoom out.

To zoom in on a rectangular area (similar to defining a Zoom Window in AutoCAD), use the Zoom Region option available from the Navigation Bar in the upper right corner, or by typing ZR and then picking two points to define the region to which you wish to zoom.

Pressing and holding the middle mouse button will activate the Pan command. Clicking and dragging with the middle button will Pan the view in the direction you drag your mouse.



To create a 3D view of your model or to switch to the current 3D view, select the Default 3D View icon from the Quick Access toolbar or the Create panel on the View tab of the Ribbon.

If a 3D view is active, you can rotate your viewing direction about the model by holding the Shift key while pressing the middle button and dragging your mouse.

When a 3D View is active, the view can also be modified in a number of different ways utilizing the View Cube or Steering Wheel controls which may be found on the Navigation toolbar.

Object Selection

To select a single object, move your cursor over the element and pick with your left mouse button.

When you move your mouse over an object it will highlight. If several elements are close together, move your mouse over them and then press TAB to highlight the objects one at a time. When the desired object is highlighted, pick to select it. You can also select an element with your right mouse button and it will display a context sensitive cursor menu at the same time.

To add items to a selection set, press CTRL and click additional elements. To remove items from a selection set, press SHIFT and click selected items. To select a series of connected elements such as end connected walls, move your mouse over one of the elements, press Tab to highlight all of the connected elements, and then pick to make the selection.

To select several items at once, click and drag to create a rectangular selection box. If you define the box from left to right it will only select objects that are entirely inside the selection box (selection window). If you choose the points from right to left it will select all objects that are partially encompassed by the selection window as well as those that are entirely within its boundary (selection crossing).

To select all instances of one type, for example all of the interior partition walls in a floor plan, pick one wall and then right click and choose Select All Instances. You can also pick the element and then type SA to select all instances. If you select an element type in the Project Browser and right-click, you will also find the option to Select All Instances.

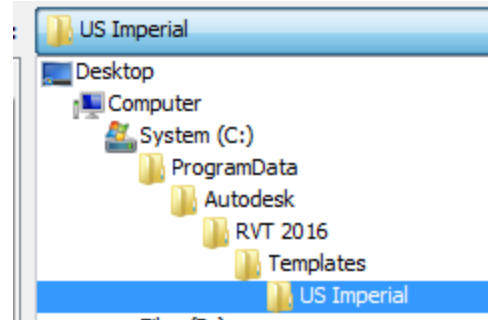
To restore a previous selection, press the CTRL key and the left arrow on your keyboard or right click anywhere in the drawing area and choose Select Previous from the cursor menu.

Whenever you select multiple elements, a filter icon appears on the Selection panel on the Ribbon. To create a filtered selection from a selection set of different elements, choose the Filter icon and then place checkmarks beside the categories to include in the selection. It may be helpful to use the Check None button to clear the list first if you only want to select items from a few categories or a single category. The Selection panel also provides options to save a selection set with a name and then restore that selection later with the Load selection option.

Exercise Notes

In the following exercise you will start a new Project with Revit, learn how to use the interface, and experiment with creating a simple building using basic walls, windows, doors and a roof.

1. Start Revit and from the recent files window, choose New / Project. In the new Project dialog choose browse and select the default Imperial template at
C:\ProgramData\Autodesk\RVT 2016\Templates\US Imperial\default.rte
 - a. Note - The path shown here is for Windows 7 installations. If you are using a different operating system such as Vista, the path may vary.
2. Look in the project browser and confirm that Level 1 is shown in **Bold** indicating that it is the current level. In the drawing area you should see four elevation tags with arrows pointing in to the location of the building you are about to create.
3. From the Build panel on the Architecture tab of the Ribbon, pick the Wall tool. In the Type Selector, at the top of the Properties palette, choose Basic Wall: Exterior – Brick and CMU on Metal Stud. On the Options bar, set the Height to Unconnected and 10' 0". (Highlight the field by picking, type 10 and hit enter). In the Location Line dropdown list, choose Finish Face: Exterior. Confirm that the Chain option is selected.
4. Pick a point in the lower left section, between the elevation tags and drag your mouse up to start drawing a wall. You will see two dimensions showing the length of the wall and its angle with horizontal axis. The wall will snap to a vertical axis and display both a tooltip and a dashed line indicating its orientation. Type 38 and hit enter to draw a 38 foot wall.
5. Drag your mouse to the right until you see the dashed line appear with a Horizontal and Extension tooltip. Instead of specifying the distance, just drag your mouse until the temporary dimension reads approximately 50 feet and pick a point. Drag your mouse down approximately the length of the first wall, and another tracking line will appear indicating a perfect alignment with the first wall. Pick a point to complete the third wall.

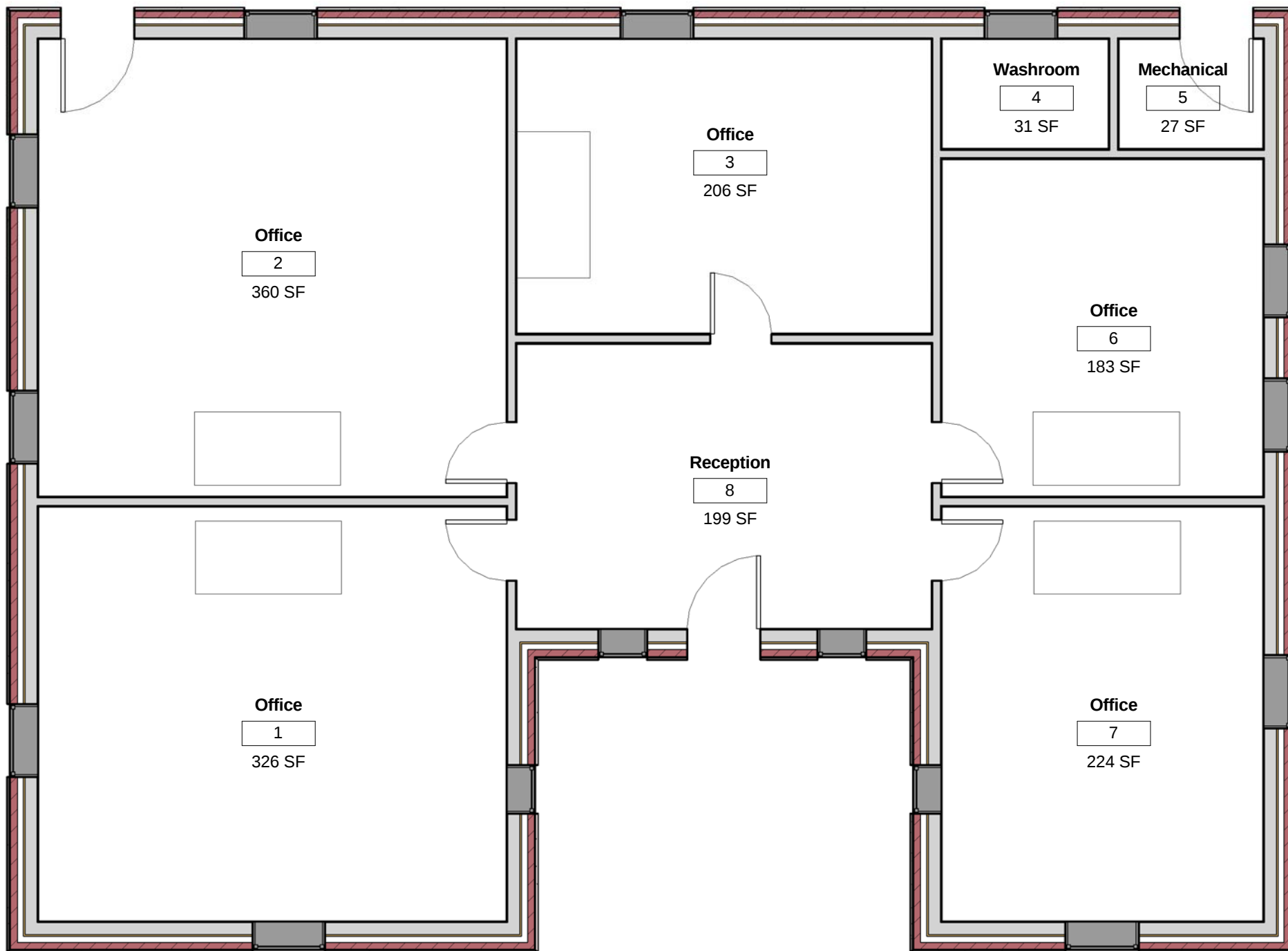


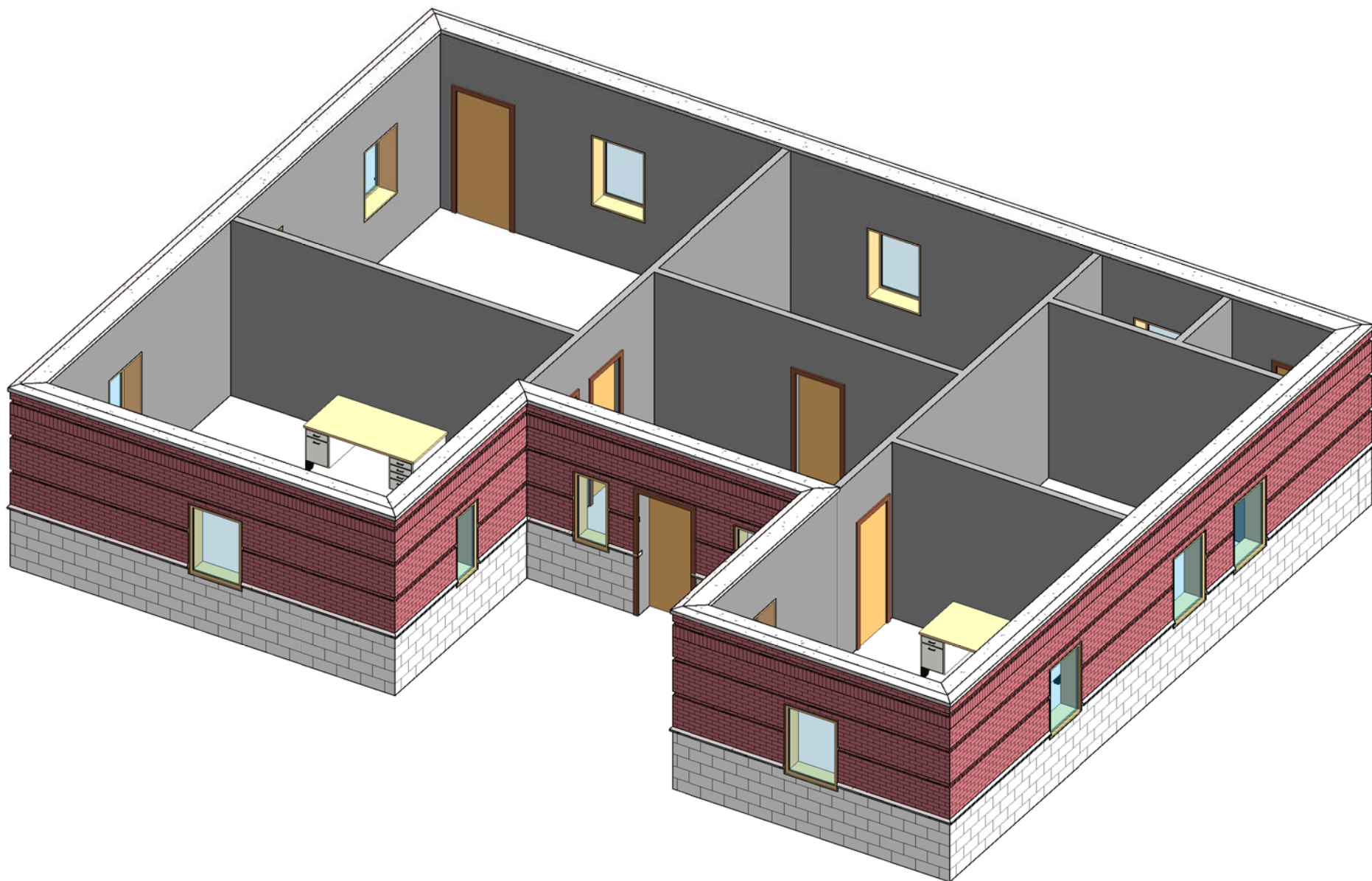
6. Drag your mouse to the left, then up, then left, then down, then left to connect to the starting point of the first wall and create a recessed section around the middle of the south wall. Don't worry about the distances, but do try to keep the walls vertical and horizontal.
7. When you have closed the perimeter of the wall, hit the ESC key once to end the chain. The wall command is still active. To one side of the building, create an L shape with two wall segments. Hit ESC again and then repeat to create another pair of walls. Hit ESC once to stop the current chain of walls. Look at the Ribbon where the Modify | Place Wall tab is still active and hit ESC a second time to end the Wall command and the Modify command will highlight. To cancel an active command hit ESC twice or just reach over and pick Modify.
8. Drag a rectangular selection window around the extra walls outside the building perimeter. Just pick one corner, drag your mouse and let go. The walls will turn blue indicating they are selected. Pick one of the building walls. Pick one of the extra walls. Each time you pick a wall, the previous selection is cleared. Press CTRL and pick the walls outside the building one at a time to add them to the selection set. Add and two of the building walls to the selection set as well. Press the SHIFT key and pick the highlighted building walls to remove them from the selection set. When only the four extra walls are highlighted, press the Delete key to remove them from the project.
9. Type ZR and pick two diagonal points to define a Zoom Region around the building. Type ZF to Zoom to Fit. Experiment with using your mouse wheel to zoom in and out. Note that the zooming will be centered wherever you place your cursor as you turn the wheel.
10. Try panning the view by pressing and holding the middle mouse button and dragging your mouse. Type ZA to Zoom All. (ZA and ZF do the same thing). Zoom in one more time and then double-click your middle mouse button to Zoom Fit again.

11. From the Build panel on the Architecture tab of the Ribbon, pick Door and in the Type Selector choose Single-Flush: 36"x84". Select the "Tag on Placement" option on the Ribbon. Move your cursor over the recessed wall along the bottom of the plan. Look at the status bar in the lower left corner to view the prompt to "click on wall....". Use your mouse wheel to zoom in on the recessed wall. Without clicking on the wall, try moving your cursor towards the wall, first from the bottom and then again from the top. Note how the side of the wall which you approach affects the swing direction of the door you are about to place. When the door appears, swinging into the building, press your space bar to see how it will flip the hinge side of the door before you place it. Shift the mouse back and forth to view the temporary dimensions showing the placement position of the door. When it is approximately in the middle of the wall, pick a point to place the door.
12. The Door command is still active and will allow you to place multiple doors by continuing to pick points along the walls. Add two more doors in the back wall, at the left and right corners. The doors should swing into the building and open against the adjacent wall. After you have added the third door, hit ESC twice to end the command.
13. From the Build panel on the Architecture tab of the Ribbon, select the Window tool. In the Type Selector, choose Fixed:24"x48". On the right hand side of the Ribbon, deselect the "Tag on Placement" option if it is enabled. We can easily tag the windows later if we wish to create a window schedule. Move your mouse over the wall to the left of the front door and click to place the first window approximately in the middle of the wall. Add three more of the same window type in this recessed section as shown on the handout. Try choosing the window position by picking the wall from the interior and exterior side and note that as with the doors previously, the side of the wall you select determines the side on which the window will be placed. Windows should be added from the exterior side of a wall.
14. With the window command still active, change the Type Selector to Fixed: 36"x48" and then place the remaining eleven windows as shown on the handout. The exact locations are not critical as we will place them accurately when we add dimensions in the next lesson.

15. With the window command still active, type WA to switch to the Wall command. Type DR to switch to the Door command. Type WN to switch to the Window command. Pick the Wall tool from the Build panel on the Home tab of the Ribbon. Selecting a new command, from either the Ribbon or with a keyboard shortcut, will cancel the previous command automatically. Set the Type Selector to Basic Wall: 4-7/8" Partition, and add the interior walls as shown on the handout. Set the location line to Finish Face Exterior, the height to Level 2, and clear the Chain option. This will allow you to add the interior walls one at a time.
16. While adding walls with a face location line, use the space bar to flip the orientation of the wall from left to right. This will be useful to help align the main north south interior walls with the inside face of the exterior walls.
17. Add the interior doors with the Single-Flush: 30x84 door type. Remember to use the Space bar to flip the doors as you insert them into the walls.
18. Type the shortcut CM or, from the Build panel on the Architecture tab, choose Component and in the type selector, choose Desk: 72"x36". Add a desk in each of the larger rooms. As you drag the desk into the rooms, the point at which it is attached to your cursor will be at the back corner of the desk. If you press the Space bar, it will rotate the component in 90 degree increments, allowing you to orient the desks against horizontal or vertical walls.
19. Type the shortcut RM or, from the Room & Area panel on the Ribbon, choose Room. Pick a point in the center of the lower left room of the floor plan to add your first Room. Continue to add Room Tags to all of the remaining rooms, selecting them in a clockwise direction around the building. Hit ESC or pick Modify on the Ribbon to end the room tag creation process.
20. To edit the names and numbers of the Rooms, select one of the room tags so the text is in blue. Pick the blue text and you will be able to type in the desired name or number. Edit all of the room names to match the handout.

21. Select one of the Room Tags, right-click and choose Select all Instances. With all of the Room Tags selected, reach into the Type Selector and change the Type to Room Tag: Room Tag with Area. All of the Room tags should now display the square foot area of each room.
22. From the Quick Access toolbar, choose the “Default 3D View” icon to switch to an isometric view of your first Revit building model. Still a work in progress, but not bad for 20 steps. 😊
23. Type SD to see a Shaded View of your model. Type HL to see a Hidden view. We’ll look at the view controls in more depth in the next lesson.
24. In the Project Browser, double click Level 1 to go back to the floor plan.
25. From the File menu, choose Saveas and save the project as Revit_1-1_XX where XX will be your initials. Backup your files to a removable drive. We will continue to develop this model in the level two class.





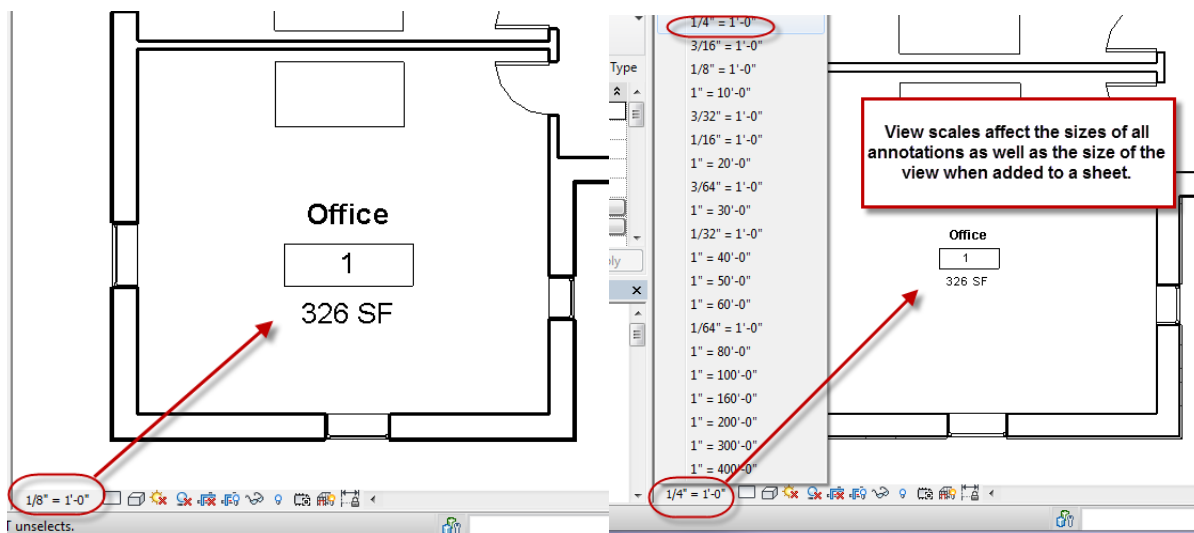
AGENDA:

1. Introduction to View Controls
2. View Properties and Visibility / Graphic Overrides
3. 3D View Navigation Controls
4. Introduction to Creating Views

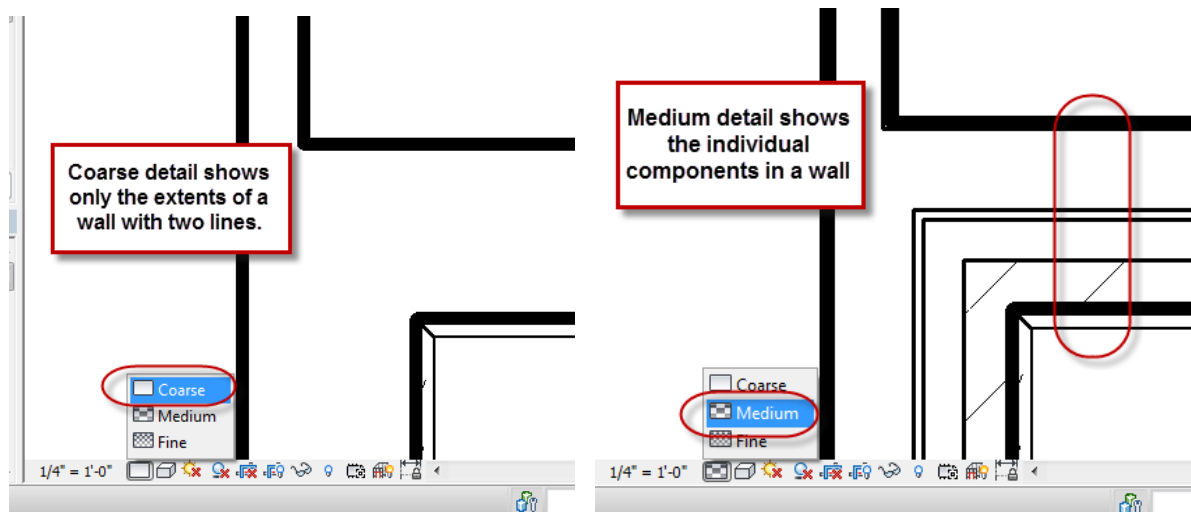
1. Introduction to View Controls and View Properties

Views in Revit may be shown with different settings which affect not only the graphics being displayed but also the level of detail which is depicted. The View Control Bar in the lower left section below the drawing view area provides access to the most commonly used settings to modify the View Properties applicable to most view types.

The SCALE setting at the left side of the View Control Bar is used to modify the size of annotation elements and control the level of detail which will be displayed for each view in your project. For example a floor plan being shown at $1/8" = 1'-0"$ might show a door with a single line for the door panel, while the same door in a plan at $1/4" = 1'-0"$, might show the same door with a rectangle for the door panel. In a plan at 1:100, notes and dimensions will appear larger relative to the size of the building elements than they will if the floor plan is done at 1:50. All text, tags, dims, etc. in Revit are linked to the scale setting for a particular view and will automatically resize if you change the scale setting.



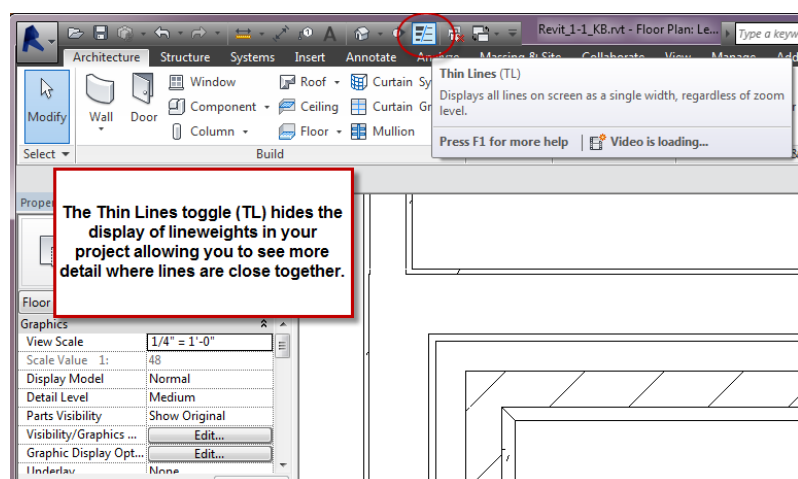
The Detail Level setting to the right of the Scale setting on the View Control Bar is used to indicate the level of detail assigned to a particular view. There are three settings available: Coarse, Medium, and Fine. Elements may be defined to show different structures as the level of detail changes. For example at a coarse level, a Brick Veneer wall might show only two lines to represent the extents of the wall. At a medium or fine level of detail, the same wall might show separate lines for the bricks, air space, sheathing, and structural backup wall.



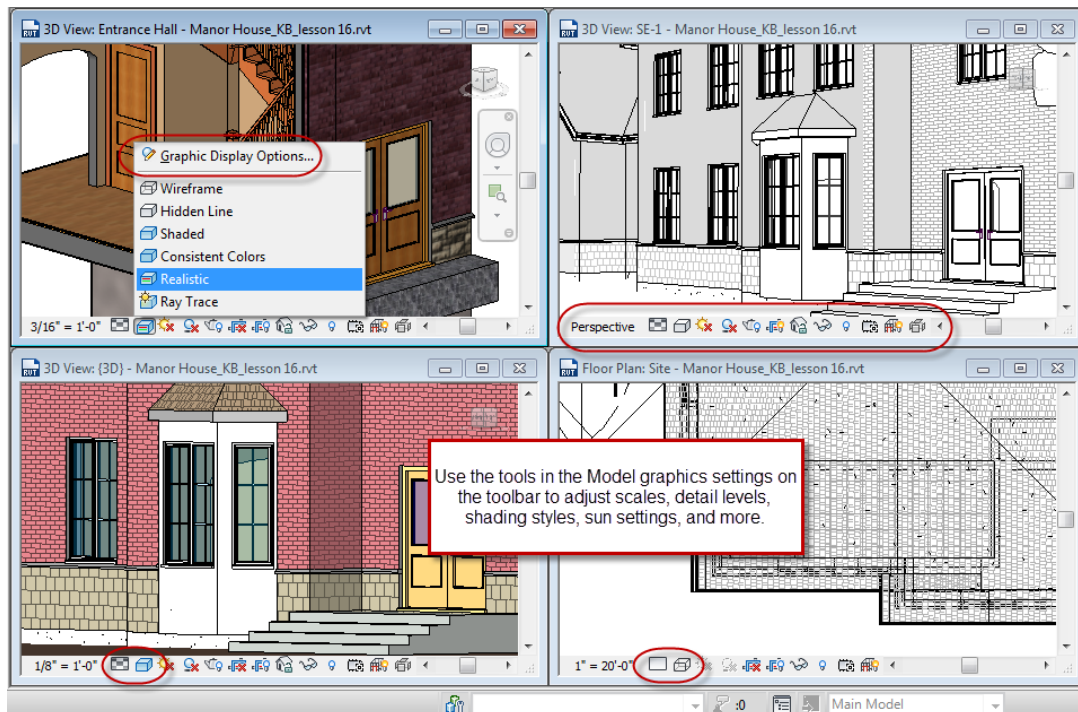
If you have trouble with line weights concealing some of the detail in your views, you can toggle the display of line weights with the Thin Line toggle on the View toolbar. This will force all line weights, in all views to be displayed with a single pixel width.

The image to the right shows the same wall type as in the images above, but the Thin Line display reveals elements which were previously hidden.

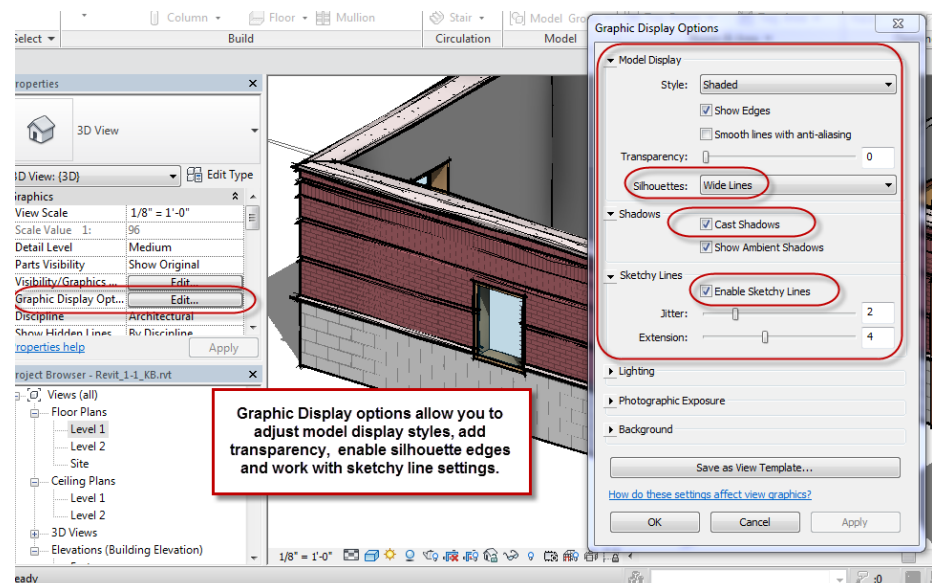
The Thin Line toggle applies to all views not just the current project view. This control is for display purposes only and does not affect plotted output.



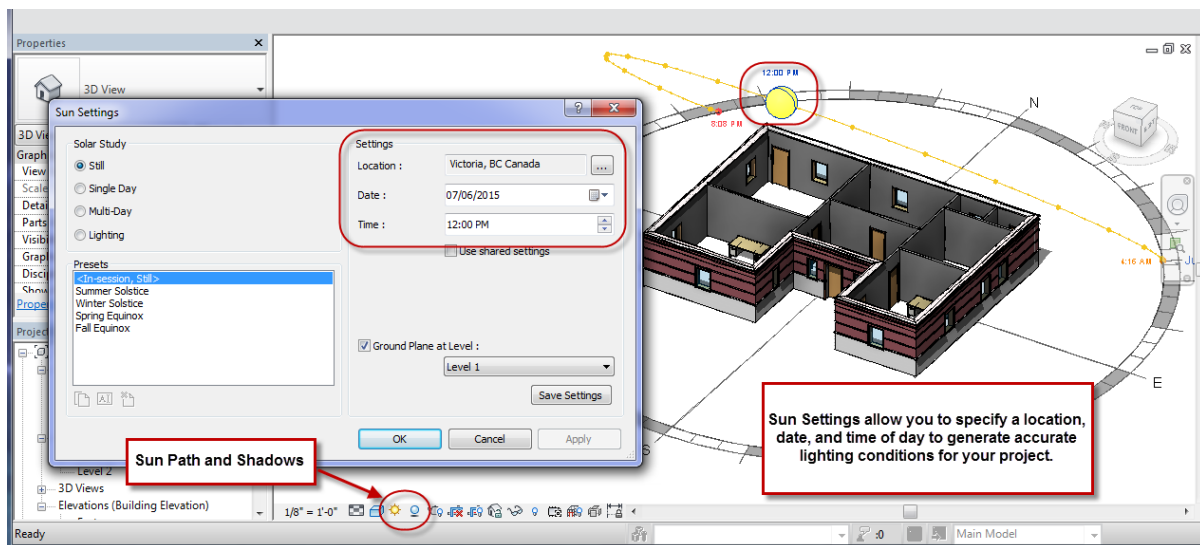
Model Graphics Styles allow you to specify different graphic styles for a view. There are six choices: Wireframe, Hidden Line, Shaded, Consistent Colors, Realistic, and Ray Trace. Model graphics may be set independently for all project views, including Plans and Elevations as well as 3D views. The Shaded views will take more processing power than wireframe or hidden.



From the cursor menu for shading style, you can open the Graphic Display Options dialog. Sketchy lines may be enabled and Silhouette Edges may be enabled for a hidden line or shaded with edges view to give an artistic touch by setting a line style for silhouette edges.

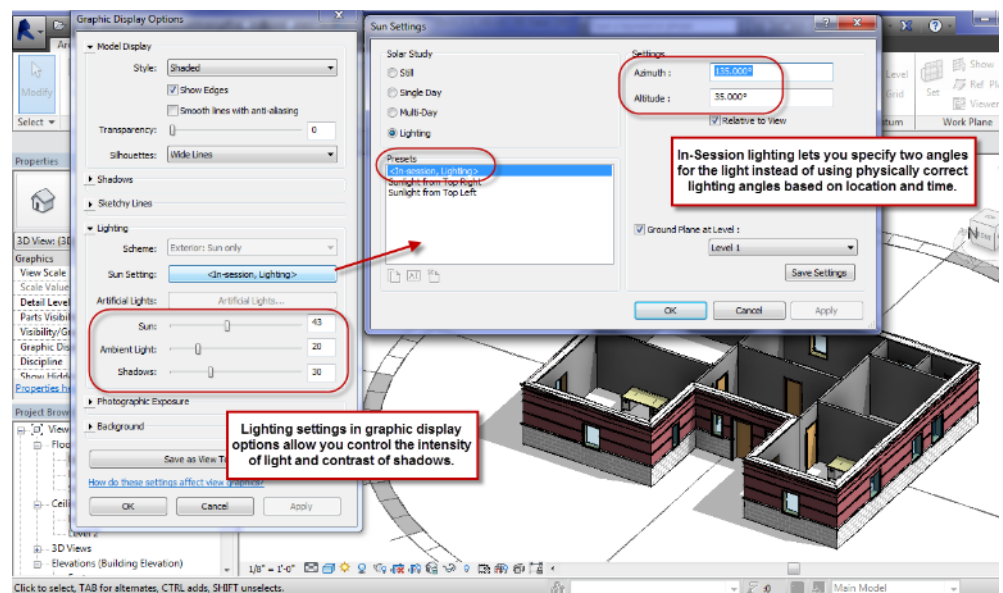


To the right of the Model graphics choices, you will find a toggle to enable a Sun Path, and another to turn on the display of Shadows for a view. The Sun Path tool also allows you to access the Sun settings for a particular view. Detailed Shadow studies can be created by setting the sun angle with a geographic location, date and time. Enabling Shadows, especially for larger models can have a significant impact on performance. Turning on the Sun Path option on the view control bar allows you to dynamically adjust the time and date in the viewport.



The Graphic Display Options dialog also provides access to lighting controls.

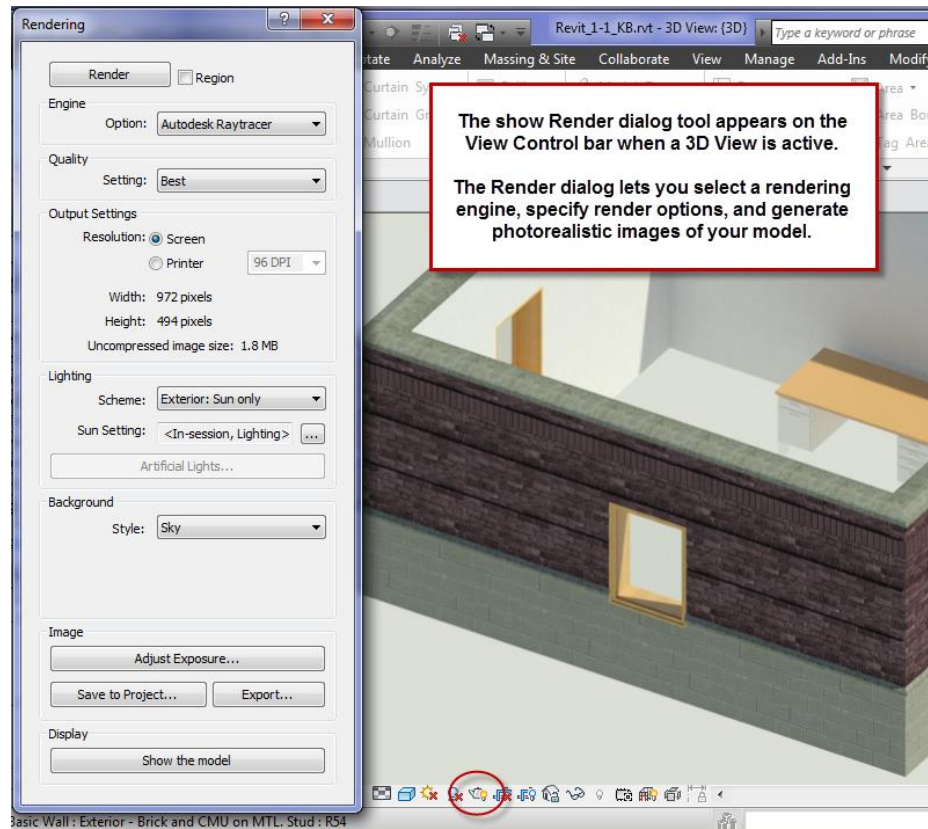
Available options allow you to set the brightness of the sun and the angle that it will use to direct light at the building, as well as how dark the shadows will appear in a shaded view with shadows enabled.



If a 3D View is current, the next setting on the View Control Bar opens the Render dialog box. Here you can choose the Quality, Output Settings, Lighting scheme, Background settings and exposure settings for a rendering. The view can then be rendered and the rendered image can be saved within the Project or exported to an external file.

Rendering has been simplified in current versions of Revit. (2016 or later) with the addition of the Autodesk Raytracer rendering engine. The MentalRay render engine is also available.

It is possible to render a plan or elevation view, by creating a 3D view and then setting it to orient to a 2D direction or existing view.

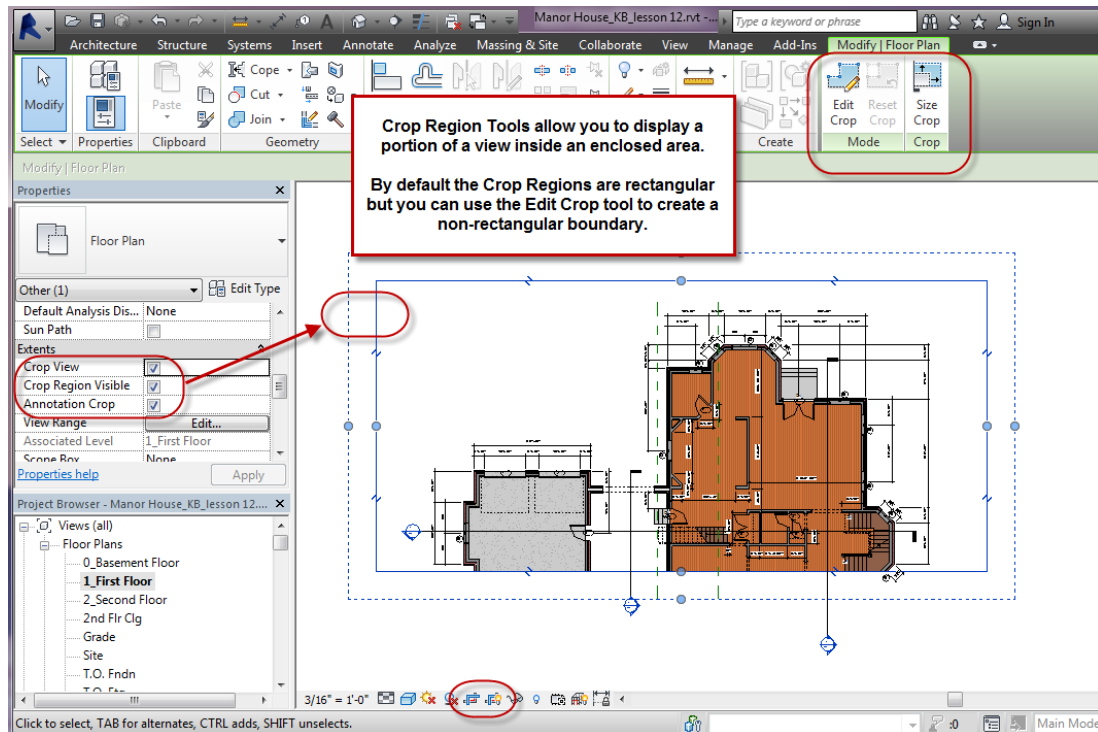


Revit generates photorealistic images of a building model complete with various effects and content such as interior and exterior light sources, realistic materials, plants, people, entourage, and decals.

Creating high quality rendered images is dependent on many interrelated factors including not only choosing the correct render setting but also generating good views, assigning the correct materials, defining appropriate lighting solutions, and making trade-offs between quality and appearance.

Rendering large images of complex models, with realistic materials and lots of lights can be surprisingly time consuming and can require patience as well as premium hardware. Rendering will be covered in depth in a future class.

The Crop Region and Show Crop Region tools on the View Control bar allow you to define a rectangular area in which your view will be displayed. All interactive views have a Crop Region which will be visible or invisible depending on how the view was created. Plan and Elevation views, for example do not display their crop region by default but Section and Detail views do display the Crop region. The Show Crop Region / Hide Crop Region tool allows you to toggle the visibility of the Crop Region Frame.



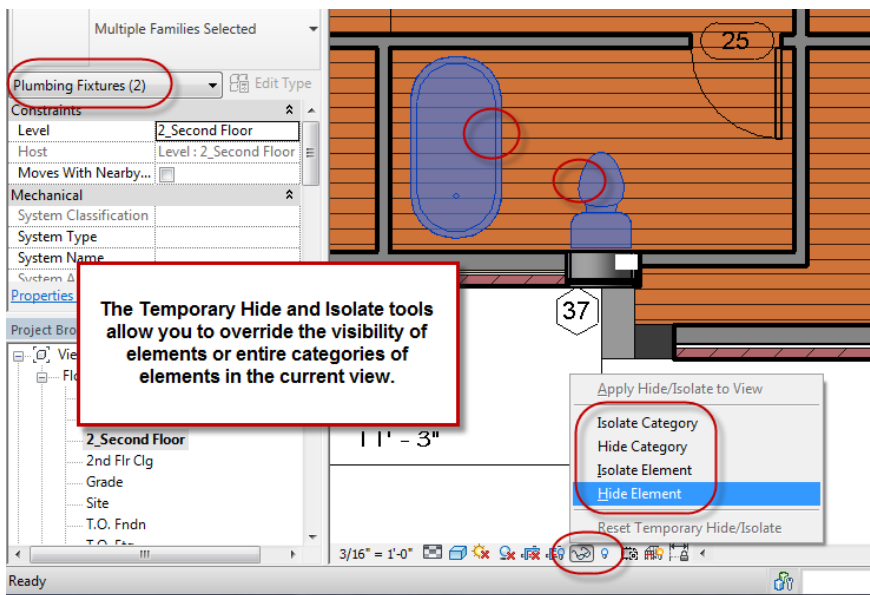
When the Crop region is displayed, you can select the Region to have it display a set of controls on each side of the rectangle which may be used to resize the region by dragging your cursor. The break marks on either side of the resize arrows allow you to optionally remove the portion of the view between the breaks, creating two viewable areas which may be repositioned to create a broken view.

The Edit crop tools on the Ribbon provide more options for creating non-rectangular enclosed areas with sketching tools. Use the Reset crop tool to restore a crop to its default rectangle shape.

If annotation displays outside your crop region, enable the Annotation Crop setting in the Properties Palette when nothing else is selected. This will turn on the display of a second crop region outside the perimeter of the main crop region. The two outlines can be resized separately.

The Hide and Isolate mode on the View Control Bar allows you to temporarily change the visibility of one or more selected elements or the categories to which they belong. This is useful when you wish to conceal items to reduce visual clutter while working or if you wish to display only one or a few elements by themselves so you can work on them more easily.

After you select the element or elements choose one of the four available options from the Hide / Isolate tool. When a temporary visibility override is in effect, the icon will turn Cyan and the drawing view will display a heavy Cyan Border. Hiding and Isolating elements in this fashion applies only to the current view, it will not affect the printing status, and it will not be saved when you close and reopen the Project.



To reset the default visibility for the view, pick the Hide Isolate tool again and choose the Reset Temporary Hide/Isolate option. To change the status of hidden elements from temporary to permanent, choose the Apply to View option.

Any element or category may be set to permanently hidden by selecting the element, right-clicking and choosing the Hide in View / Element or Category option.

To restore the visibility of elements which have been permanently hidden or to select a set of temporarily hidden elements to change their status, use the Reveal Hidden Elements tool at the right end of the View Control Bar. While in Reveal mode, you will be able to see all elements. Visible elements will display in a grey halftone color, temporarily hidden elements will display in Cyan, and permanently hidden elements will display in a Magenta color. Select an element and right click to access the Hide or Unhide in View option.

2. View Properties and Visibility Graphics Overrides

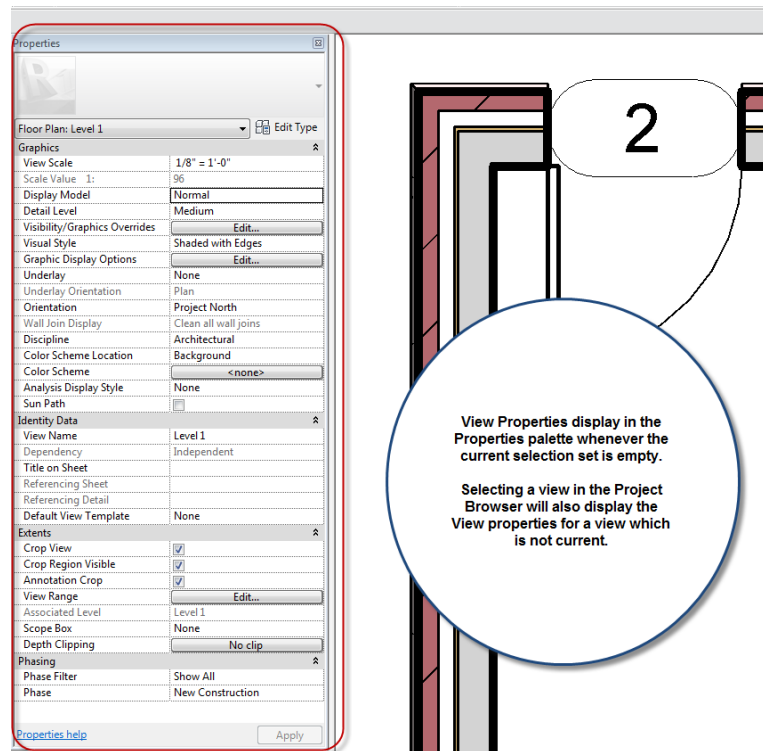
All of the controls and settings from the View Control Bar are also available along with many other powerful options, from the View Properties dialog. The View Properties for the current view will display in the Properties Palette whenever nothing else is selected.

The contents of the View Properties palette will vary somewhat with the current view type. Most views have controls for all settings on the View Control Bar as well as access to Visibility Graphics Overrides for the

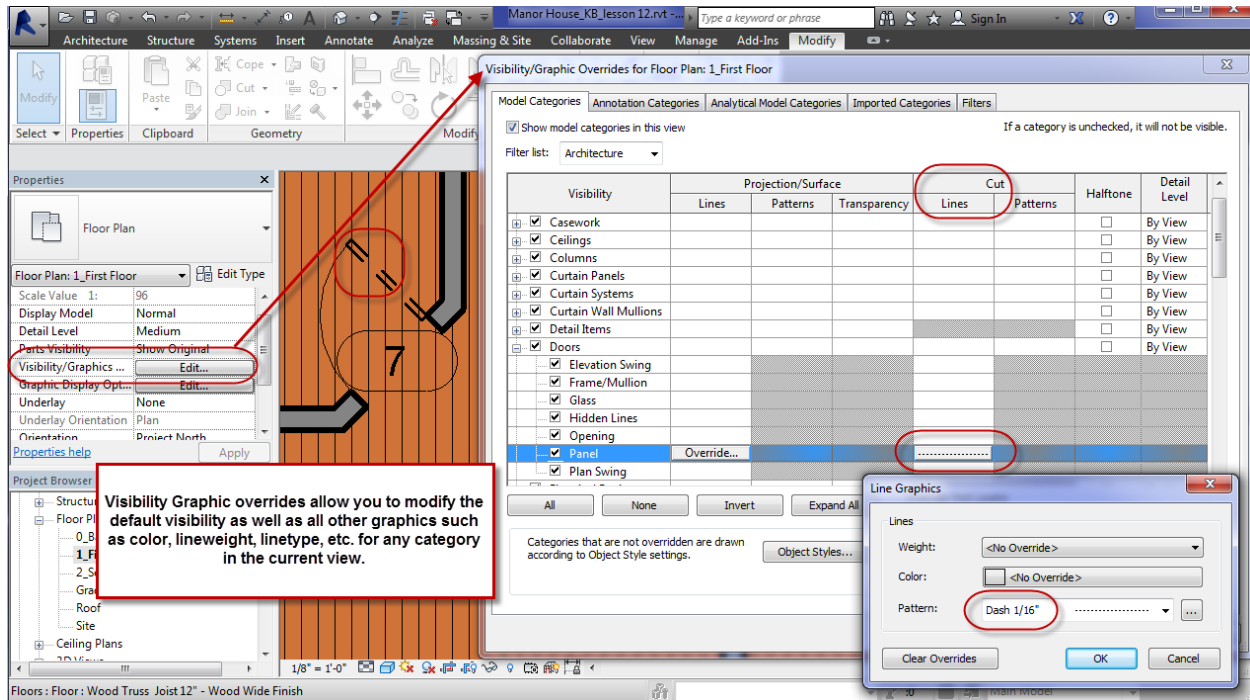
current view. Additional settings included identity data, Underlay information, view name and title on drawing sheets, view ranges and Phase settings.

The Underlay field is a setting unique to plan views, which allows you to specify another slice of the model to display under the current plan view. That slice of the model can be from any height in the building, above or below the current view. By default, in a second floor plan the first floor plan will be displayed in a dimmed, light grey fashion. This can be useful to help align objects such as bearing walls or windows from one floor to the next. When working on a foundation plan, you can set the Underlay to display the floor above.

View Range is another plan property with which you can specify the exact locations for the vertical boundaries of the view. These are specified with the Cut plane height as well as the top and bottom clip planes for the view. These controls can be useful when working with a plan that contains varying floor levels such as a mezzanine. The view range is also useful when setting up a roof plan view.



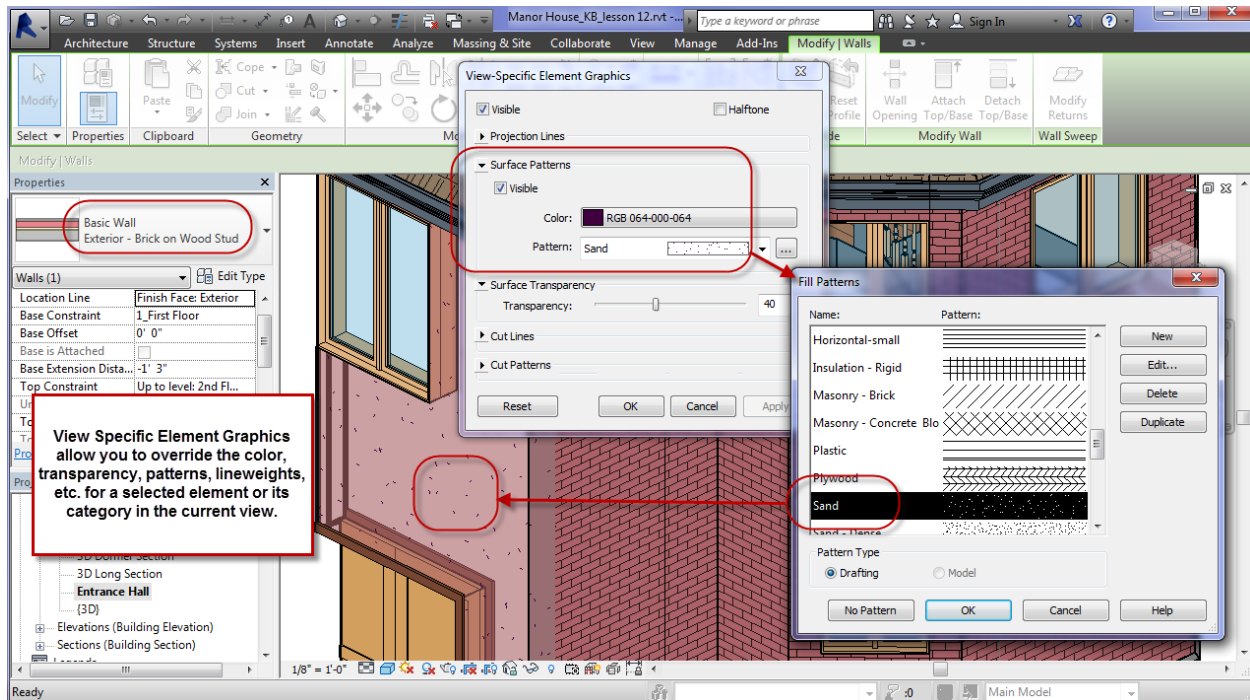
The *Visibility / Graphic Overrides* dialog box, accessed by typing VG or from within the View Properties dialog box, allows you to override any of the default visibility and graphics settings for the display of every type of element which can be created in Revit. These overrides will only apply to the current view.



Controls are grouped under five tabs for Model, Annotation, Analytical Model, Imported, and Filters categories. Every sub-category of every element category has settings for how they will be depicted in various types of views. Projection and surface settings for elevations and Cut settings for plans and sections. Hatch patterns, line weights, line types, and colors as well as the visibility of each element part may be defined. In the image above, the Door Panel sub-category of the Door category has been overridden to assign a dashed line type to the door panels. This will apply to every door of every type in the current view.

If you wish to modify the default behavior or appearance of an element category on a project wide basis, select the Object Styles button in the lower section of the Visibility / Graphic Overrides dialog. Object Styles may also be found in the Settings Menu. Object Styles control the default settings for the entire project and Visibility Graphics overrides can modify those settings on a per view basis.

If you wish to modify the appearance of one or more specific elements in a single view, you can select the objects, right click and choose **Override Graphics in View / By Element**. This will open the *View-Specific Element Graphics* dialog. Here you can set visibility, halftone, and transparency as well as graphic controls such as color, line weight, and pattern for projection lines, surface patterns, cut lines and cut patterns.



The Halftone setting will blend the line color of an element halfway with the background color of a view. Halftone has no effect on material color in shaded views. The surface transparency slider setting will display selected objects with only their edges and fill patterns visible in a semi-wireframe style that allows you to view other objects beyond.

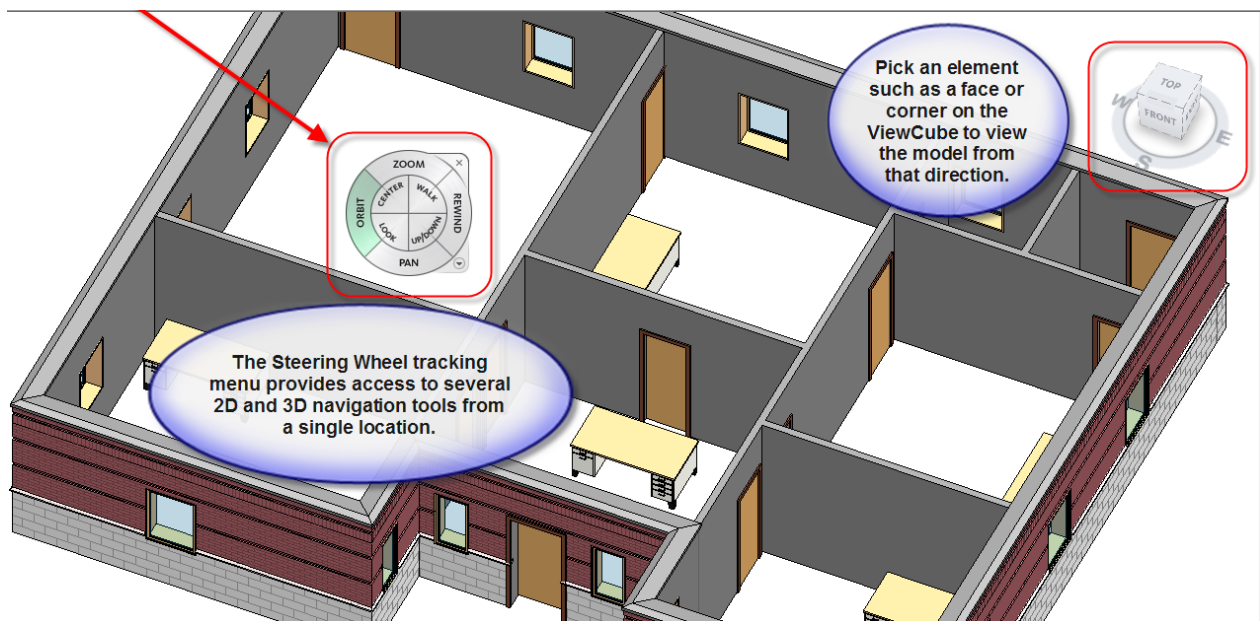
To remove all element graphics overrides, repeat the selection, access the Element Graphic overrides dialog and pick the Reset button in the lower left corner.

If you select objects, right click and choose **Override Graphics in View / By Category**, it will open the same Visibility / Graphic Overrides dialog as for selected elements, but the overrides will apply to all element instances belonging to the selected element's category.

3. 3D Views and Navigation Controls

Selecting the Default 3D View icon on the Quick Access toolbar will create a standard isometric view of your 3D building model. There are a number of ways to change the viewing direction as well as the graphic display of your building.

In all versions of Revit, you can spin a 3D viewing direction at any time by pressing the Shift key, holding down your middle mouse button and dragging your cursor in the direction you wish to orbit the camera around the centre of the view. 3D viewing directions may also be modified with the View Cube and Steering Wheel controls.

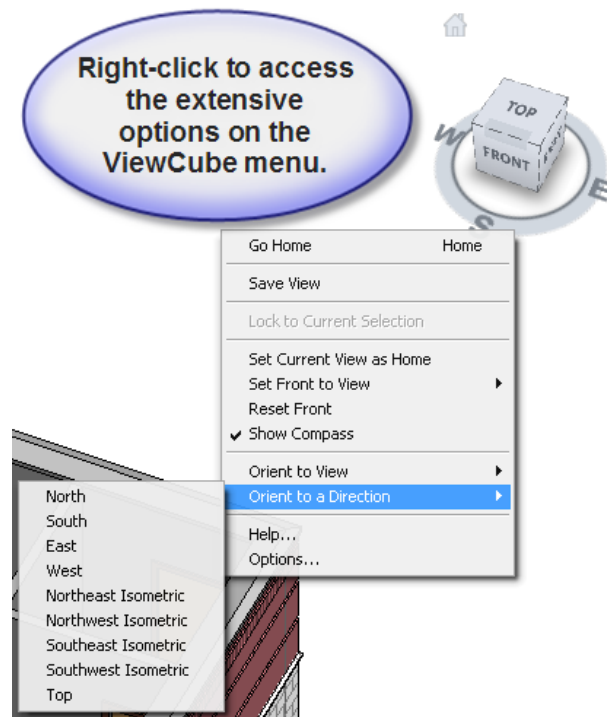


By default, The View Cube will automatically appear in the upper right corner of all 3D views. It initially shows in a semi-transparent Inactive state. When you move your cursor over the View Cube, it becomes Active as indicated by changing to Opaque and displaying a small house icon above and to the left.

When the View Cube is active you can select any face, corner, or edge and the current view will switch to match that orientation. By default, the View Cube will also display a compass with direction labels for N, S, E, and W which may also be selected to set a view direction.

If you pick and drag over the Active View Cube, it will dynamically orbit your view to match the cube rotation.

The View Cube menu allows you to select from all available views including orthographic and isometric directions, any defined plan, elevation, or 3D views, and a Home view which by default will be set to a Southeast Isometric. After setting any 3D viewing direction, you can redefine the Home view from the View Cube menu by selecting the Set Current View as Home option.



You can also redefine the direction which is considered to be the front view of your building. If your design has the front elevation facing East, you can set this appropriately with the Set Front to View flyout.

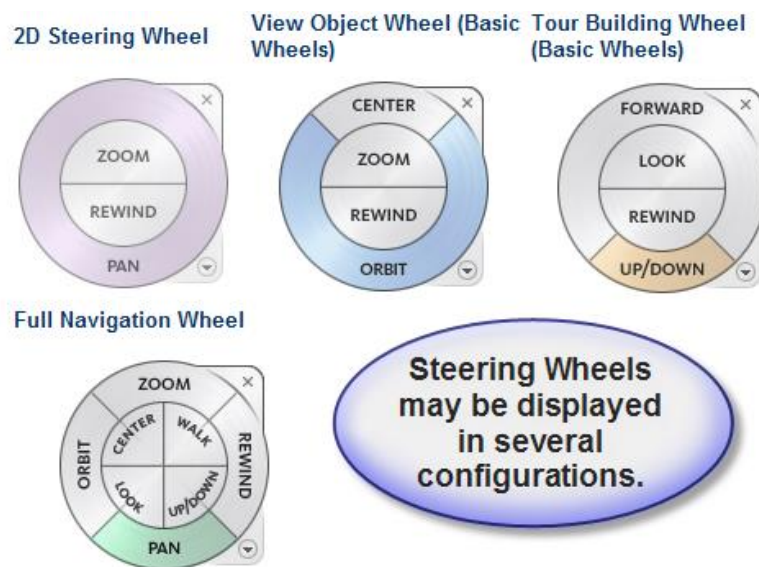
If you select an object and then pick a preset viewing direction with the View Cube, the selected object will be used to define the extents of the new view as the viewing direction changes. It will rotate the view and Zoom in until the selected object fills most of the view.

Selecting Options from the View Cube menu will allow you to control its size, position, opacity and default behavior. To disable the View Cube, toggle its display from the Window menu in any 3D View or deselect Show View Cube in the options dialog.

With the Default 3D View current, you can right click on the view name in the Browser and use the Duplicate View option to create a new, named 3D view. After creating the new view, adjust the view direction as required and then give it a descriptive name by right-clicking on the view name in the browser, and choosing Rename. You can also rename any view by setting it current and then editing the View name property in the Identity section of the properties palette. You can create as many 3D Views in this fashion as required.

Steering Wheels are tracking menus that allow you to access a variety of 2D and 3D Navigation tools from a single tool. The Steering Wheel is view sensitive and will display different options in 2D and 3D views. In a 2D view you will have options for Zoom, Pan, and Rewind which allows you to step back through a series of previous views.

In a 3D View, accessing the Steering Wheel tool icon from the View Toolbar, allows you to open a wheel in one of 3 main configurations: View Object, Tour Building, or Full Navigation. Each wheel is divided into several wedges with a tool on each wedge. You can also display the



steering wheels as Mini Wheels which do not include text labels for the tools and are less obtrusive as you work. Highlighting any wedge displays a tooltip.

As you work, the wheel follows your cursor around the screen. Moving your cursor over one of the wedges and picking, will activate that tool.

The View Object wheel provides 3D navigation tools designed to view objects from the outside. Tools include Center, Orbit, Zoom, and Pan.

The Tour Building wheel provides tools to navigate within the interior of a building. Tools include Forward, Walk, Look, Up/Down, and Rewind. The Full Navigation wheel combines all of the tools from View Object and Tour Building.

Right-clicking a steering wheel provides extensive options for switching wheel types, setting preset views current, accessing options, and Saving a View if a 3D view is current.

Introduction to View Creation and View Navigation Tools

Many View types are available for creation in Revit. A Project started with any of Revit's default templates will include a number of views that are premade including floor plans, ceiling plans, and elevations. These will all appear in the Project Browser under Views.

New Views may be defined a number of different ways including choosing New View tools from the Create Panel on the View tab of the ribbon, adding new Levels to the project , creating camera views, saving new views from the View Cube or Steering Wheel menus, and duplicating existing views. The first time you select the Default 3D View tool in a project, it will generate the initial 3D view.

Levels may be created by choosing the Level tool on the Datum panel of the Architecture tab on the Ribbon and then drawing a line at the desired height in the current view. This method of level creation will automatically create associated plan views. Levels may also be copied in a section or elevation view, but this method does not create associated views. This technique is used to create reference datum levels for which you do not want to create a plan view. For example the Top of Foundation Footing or the Top of Foundation Wall are useful reference points which do not require their own plan views.

Views may also be created from the View menu or from the View tab of the Design Bar. Plan views may be created by referencing existing levels. Detail, Section, and Elevation views are created by dragging reference elements such as section marks or elevation tags into an existing view. Perspective views may be generated by adding Cameras to Plan Views. Walkthrough views are created by defining a path for the camera to follow.

The Project Browser is used to navigate between existing views by double-clicking the View name. If you right-click a view name in the Project Browser, you can choose to Rename the view, Delete the View, access the View Properties, or Duplicate the View.

In addition to using the Project Browser to navigate views, you can also switch between views by double-clicking view reference graphics such as elevation marks, section marks, and levels. Double click the blue portion of any view reference to switch to that view.

Exercise Notes

In the following exercises you will explore the various methods for controlling the visibility and graphic properties for elements in different views. You will also learn how to navigate 3D views, and learn basic methods for creating, deleting, and renaming views.

1. Open the project you started in Lesson 1. In the Project Browser, double-click Level 1 to set it current if your 3D view is still active from the previous lesson. Type ZF to Zoom to Fit and then ZR to define a zoom region around the plan extents.
2. On the View control bar in the lower left of the drawing area, pick the scale and change it to $\frac{1}{4}" = 1' - 0"$. When you change the scale, Revit will automatically redraw all annotation elements relative to the new scale setting. Note that the elevation tags and room tags are both smaller than they were before. Change the scale to $1/16" = 1' - 0"$. Change it again to $1" = 1' - 0"$. Change it once more to $3/16" = 1' - 0"$.
3. Type ZR and zoom into a small area where you can see an exterior wall and an interior wall. On the View Control Bar, beside the scale setting, change the Detail Level from Coarse to Medium. You should now be able to see all of the components that make up the wall except for the inner layer of Drywall.
4. From the Quick Access toolbar, select the Thin Lines icon to hide the line weight assignments. Now you should be able to see every component in the walls, including the layers of Drywall on the interior partitions.
5. Zoom back and Pan over using your middle button and mouse wheel until one office fills your drawing area. Select the Thin Lines icon again to enable the line weight display and note how much easier it is to read the shape of the walls and openings with line weights enabled. This is how the view will plot, regardless of the Thin Lines setting which is only meant to affect the onscreen display. Try changing the Detail level to Fine (no change) and then back to Coarse. Some elements will depict 3 different levels of detail, some will have two, and others may look the same at all detail levels.

6. Select the 3D View icon from the Quick Access toolbar or double click on the {3D} view listed in the Project Browser to set it as the active view. Type ZR and define a Zoom Region around one of the front walls.
7. On the View Control Bar, beside the Detail Level, pick the Model Graphics Style and set it to Wireframe. Pick it again and choose, Hidden. Change it to Shaded. Try setting it to display Consistent Colors and also the Realistic shading.
8. The keyboard shortcuts to switch between the three most commonly used graphics modes are WF, HL, and SD. Try typing all three to see how quickly these shortcuts can be used to set the current mode.
9. On the View Control bar, to the right of the Graphic mode, select the Shadows On tool to enable shadow display for your model. Depending on the graphics card in your computer, it might take a few seconds to regenerate a view with shadows. When the shadows appear, type WF to switch to wireframe and the shadows will disappear. Type HL to go to a hidden line view with shadows. Type SD to go back to the Shaded style.
10. The direction of light is casting shadows over the front of the building. We can adjust the Sun's direction with the Sun Settings options on the Sun Path pop up on the view control bar. We can also change the location and intensity of the shadows. In the properties palette, choose the Edit button beside Graphic Display Options. Expand the Lighting section and select the button beside Sun Setting to open the Sun Settings dialog. Under Solar Study, choose Lighting. Set the preset to Sunlight from Top Left. Pick the apply button and you will be able to see the effect of any changes without exiting the dialog box. Pick ok to close the Sun Position dialog.
11. Still in the Graphic Display Options, try adjusting the sliders for Sun Intensity and also for the Shadows settings. Experiment with different values, choosing Apply to preview the changes. Set the Sun to 75 and the Ambient Light to 25.
12. Under Model Display is the Silhouette style for edges. In the dropdown window for this section select Wide lines and pick Ok to close the dialog. Note the heavy lines drawn around the edges of the model from enabling the Silhouette Edges.

13. Open the Graphic Display options again and enable the gradient fill for the Background. Close the dialog and experiment with changing your 3D view so you are looking down on the model and then up at the model from below. Note the color changes between the "ground plane" and the "sky".
14. On the View control bar, pick the Sun icon and choose "Sun Path On". In the warning dialog, choose the option to "Use the specified project location, date, and time...." option. The Sun Path, when displayed, will show a compass rose, the current project date and the current time with the sun displayed as a yellow sphere. Try picking on the date, highlighted in blue and change the date. Pick outside the date field to set the change and update the sun position.
15. Pick directly on the arc of the sun path and then pick and hold your cursor over it a second time. Drag your mouse to adjust the date dynamically. Pick again directly on the Sun sphere and try dragging it as well to adjust the time of day as well as the date. Experiment a bit with the different changes you can make with the Sun Path and then set it to the current date.
16. Type ZF to Zoom to Fit. Experiment with zooming in and out with your mouse wheel or by defining Zoom Regions. Try panning the view. You may see that working with shadows enabled will make it take longer to change views as Revit will need to recalculate the shadows each time. Toggle the Shadows off. Try panning and zooming around the model again.
17. The silhouette edges are still displayed and may be turned off and on independent of the Shadows. Open the Graphic Display Options again and set the Edges line style back to none. Pick Ok to close the dialog and return to the view.
18. Zoom into one of the rooms where you can see a desk against a wall. From the View Control Bar, select the Render tool. (teapot icon) In the quality pulldown, select Medium. Review the other settings in the Render dialog without adjusting anything and then pick the Render Button at the top of the dialog box. The rendering will be drawn on your screen in two passes over the next few seconds or possibly a couple of minutes depending on the size of your view and the speed of your computer processor. View the wall behind the desk and see if you can notice a slight reflection of color on the wall from light bouncing off the desk. This type of color bleed effect is very realistic and helps to make renderings much more believable.

19. At the bottom of the Render dialog, pick Show the Model. Pick Show the Rendering. I like that too.
☺ Now, in the Image section, choose Save to Project and call the image 3D Test Render 1. Pick OK. In the same section, choose Export, in the name field, enter 3D Test Render 1. Confirm the file type is set to jpeg and browse to the desired file location. Pick ok.
20. Close the Render dialog. The view will revert back to the shaded view. In the Project Browser, under Views, a new Renderings category has been added. Expand this category and double click the 3D Test Render 1 to display your saved rendered view. Double click on the Level 1 view in the Project Browser to switch to the floor plan view.
21. Type ZF to do a Zoom to Fit. You have probably noticed by now that when we Zoom to Fit, the elevation tags in the plan view are also included in that calculation. If they are spread out much larger than our actual building, we have to do more zooming than we should. Zoom in on one of the tags. Move your cursor over the triangle portion until it highlights and shows a tooltip indicating that it is a view. Pick the triangle and a line appears indicating the defining location for the West elevation view. The properties palette will show a description of that view and all of the properties controlling its appearance. Double click the triangle to switch to the elevation view.
22. In the Project Browser, double click Level 1 and you will return to your previous view. Float your cursor over the rectangle and it will highlight separately from the triangle.. Pick it to view its properties. This is a separate part and if you pick the Edit Type button in the properties palette, a new dialog appears. Because there are two parts to this elevation tag, you need to ensure that if you move one, the other moves as well.
23. Pick a point above and to the left of the tag and drag your cursor down and right to select both portions of the tag and then move the elevation tag closer to the building. Repeat with the remaining tags. Now, type ZF to Zoom to Fit and your building will occupy a larger portion of the view.
24. On the View Control Bar, choose Show Crop Region and then Crop View tool and if the elevation tags are inside the rectangle they will be hidden. Type ZF and it will zoom further away from the model. Select the Show Crop Region tool beside the Crop View tool and you will see why. Cropped views will zoom to the extents of their crop region. Select the Crop View toggle again to disable Cropping. Type ZF.

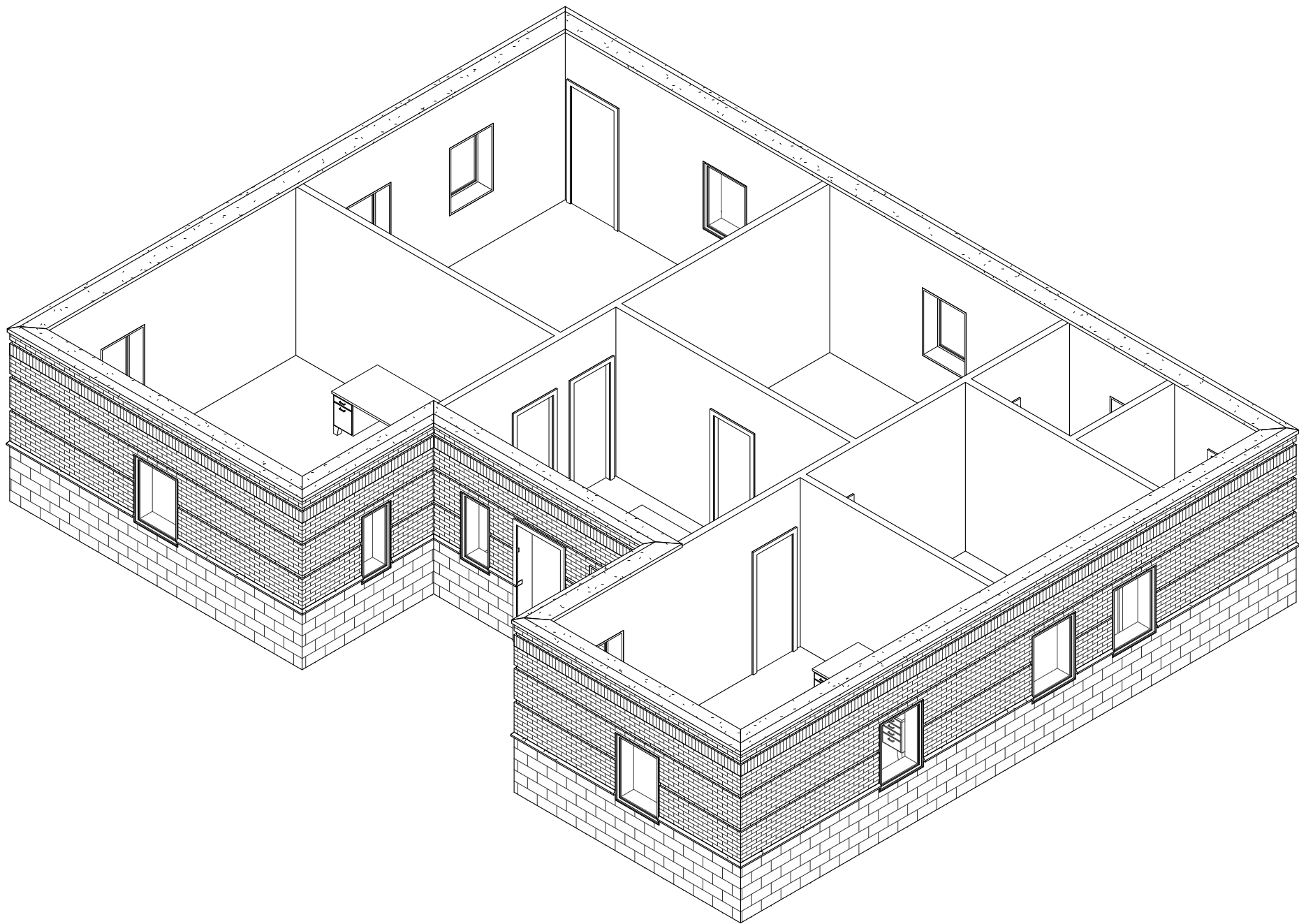
25. Cropped views may be used to enlarge a specific area of a drawing. If we wanted to work on only the west wing or only the entrance area of this building, we could crop a view to focus on that section and hide the rest of the plan. In the Project Browser, right click on the active Level 1 heading and choose Duplicate View / Duplicate. In the Project Browser the new view, Copy of Level 1 is now active. Note that the room tags and door tags are not included in this view. Right click on the current view in the Project Browser and choose Delete.
26. When you delete an active view, Revit will switch back to the last view which was active, in this case the Level 1 view. Right-click the Level 1 view again and choose Duplicate View / Duplicate with Detailing. This time the copied view has retained the annotation tags. Select the Crop View tool. Type ZF. Select Show Crop Region. Move your cursor over the Region frame until it highlights and then pick to select the Region. Pick and drag the blue control circles to resize the Region frame and adjust the border to display just outside the Office 106 walls.
27. The annotation tags from the previous view have been duplicated in this view and the tags outside the Crop region are still visible. We don't need to see them but if you delete the tags you will also delete the associated elevation views so instead we can hide them with the annotation crop region.
28. Clear any selection and in the Properties palette scroll down to the Extents section. Select the Annotation Crop option and pick OK. Select the crop Region and a second region will appear as a dashed line. Resize the annotation crop as close as possible to the basic crop region.
29. In the View Properties palette, under Graphics, set the View scale to $3/8" = 1'-0"$ and the Detail level to Medium. Pick Ok to apply and close the dialog. Type SD to shade the view.
30. Since we copied this view with detailing, all of the door tags were copied as well as the Room Tag. We can hide one or more elements of any category a number of ways. Pick one of the door tags, right-click and choose Hide in View / Element. Select the Reveal icon from the View Control Bar. The hidden element is shown in the same red color as the Reveal mode border around the View. This indicates it has been permanently hidden and will not be plotted. Disable the Reveal mode to hide the element again.

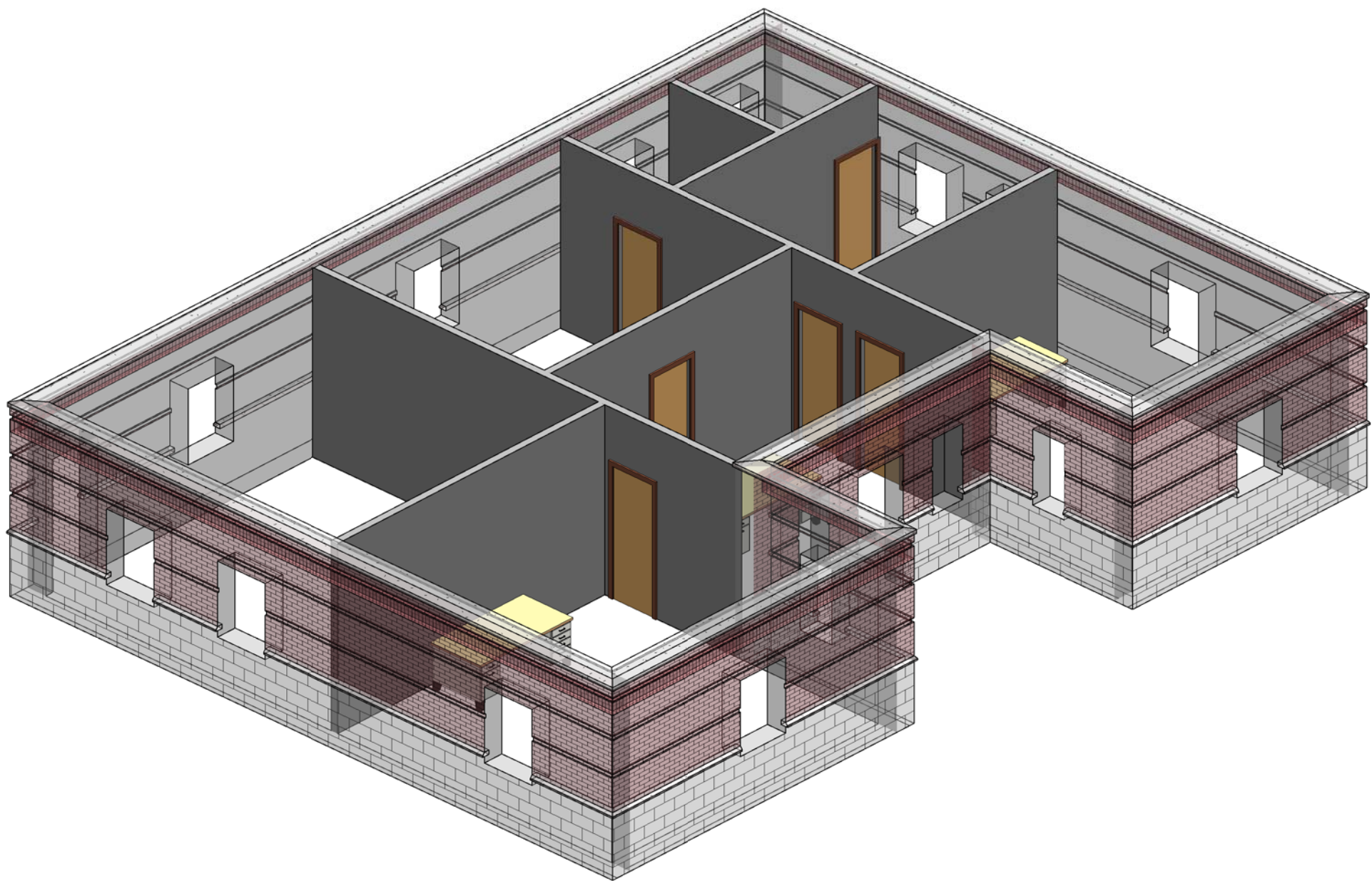
31. Select a second door tag, right click and choose Hide in View / Category. This time all door tags will be hidden. Select the Reveal tool to show the hidden elements. Pick one of the red door tags and from the options bar choose Unhide Category. All of the door tags except the one that was hidden at an element level are shown in grey. Select this last tag and from the options bar choose Unhide Element. Toggle the Reveal mode back off and all of the tags will be visible again.
32. When Element categories are hidden, it disables the visibility setting for that category in the Visibility / Graphic Overrides dialog box. Type VG to access these settings. Select the Annotation Categories tab at the top and deselect the Door Tags under Visibility heading. Pick Ok. Select the Reveal tool and you will the door tags again shown in Red.
33. In the Project Browser, under 3D Views, double-click the {3D} to switch to the default 3D view. Move your cursor over the View Cube in the upper right corner and try picking on the various corners, edges, and faces, which highlight as you float your mouse over them. Pick and drag on the View Cube to dynamically orbit the view in any direction. Zoom in on one room and try picking or dragging on the View Cube to adjust the view. The center is at the middle of the model and not the middle of the current view Zoom into one of the rooms with a desk. Select the desk and with it highlighted, pick and drag on the View Cube again. This time the center of the orbit is at the centroid of the selected objects.
34. Press the Shift key and pick and drag with your middle mouse button. Try selecting different elements in the model and use the Shift-middle button method to rotate your view. This method orbits the view in the same fashion and you may find it more intuitive than the View Cube.
35. Select one of the Desks and from the Temporary Hide Isolate tool on the View Control Bar pick Isolate Element. The screen border will turn Cyan indicating that objects are temporarily hidden. Examine the Desk family from all directions by picking and dragging with the View Cube and also with the Shift-Middle button method.
36. Toggle the Reveal mode to see the rest of the building in its Cyan, hidden state. Toggle Reveal back off and then from Hide / Isolate choose the Reset option. Obtain a view of the model from the Southwest Direction. Select one of the Exterior Walls and set it to Hide element from the temporary Hide / Isolate tool. This allows you to look into the building. We can also set the walls to be transparent instead of hiding them. Reset the Hide Isolate.

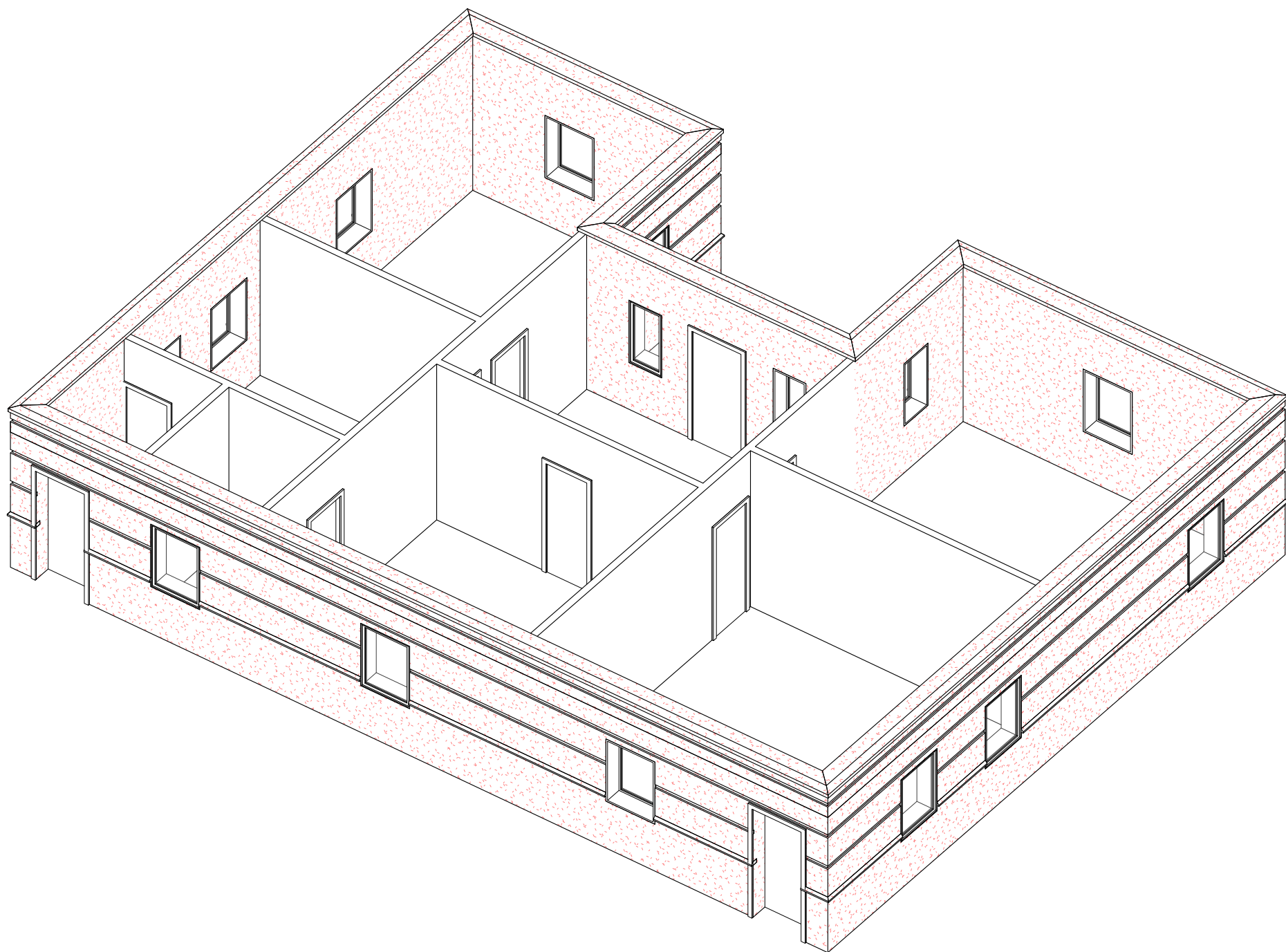
37. Move your mouse over one of the exterior walls and when it highlights, press the TAB key to highlight the entire chain of end-connected walls. Pick one wall and all will be selected. Right-click and choose Override Graphics in View / By Element. In the View –specific element graphics dialog, expand the surface transparency option and adjust the slider to 50. Choose the Halftone option at the top and pick Apply. Review the remaining options and close the dialog.
38. Pick one Window, right click and choose Hide in View / Category. Select the front door, right-click and choose Select all Instances. With the three exterior doors selected, right-click and choose Hide In View / Element.
39. Right-click on the View Cube and choose Save View. Name the new view SW Iso-Transparent Exterior. Note the new view name under 3D Views in the Project Browser.
40. Select the 3D View icon on the Quick Access tool bar to switch to the Default 3D View. Select the Steering Wheel tool from the navigation toolbar and move your cursor back over the drawing area. The Full Navigation Wheel appears attached to your cursor. Select the arrow in the lower right corner of the Wheel or right-click to see the available options. From the Basic Wheels flyout, choose the View Object Wheel.
41. Pick and drag on the Center option on the View Object Wheel and you will be prompted to select a pivot point somewhere on your model. Place the pivot sphere on one of the doors.
42. After setting the Center pivot point, highlight the Orbit option and pick and drag to orbit the view around the Center point. Pick Center again and drag the pivot point to a new location. Orbit the view again until you can see the back wall of the building. Pick the X in the upper right corner of the Wheel to close the tool.
43. Pick one of the desks, right-click and choose Hide in View, Category.
44. Pick one of the exterior walls, right-click and choose Select all Instances. Right-click again and choose Override Graphics in View / By Element. Expand the Surface Patterns section and in the pattern section select Gypsum-Plaster. Select the Color button and choose the upper left corner in the basic colors section to set a Salmon color for the plaster. Pick Ok and then Ok again. Type HL to switch to a Hidden Line view.
45. From the View toolbar, open the Steering Wheel and drag it into the view. Orbit, Pan and Zoom the view to obtain a steep angled view from above and the rear. When it looks good, right-click on the Steering Wheel and choose Save View. Call the new view, NW_Stucco_Walls and pick Ok.

46. Switch to the Level one view. Type VG and select the Annotations Category. Under visibility, clear the checkmark beside Elevations. Pick OK. Type ZF to Zoom to Fit. ☺
47. Save your project and backup the file to a removable drive. We will continue with this exercise in the next class.









AGENDA:

1. Dimensions and Constraints
2. Selecting and Manipulating Content
3. Editing Tools

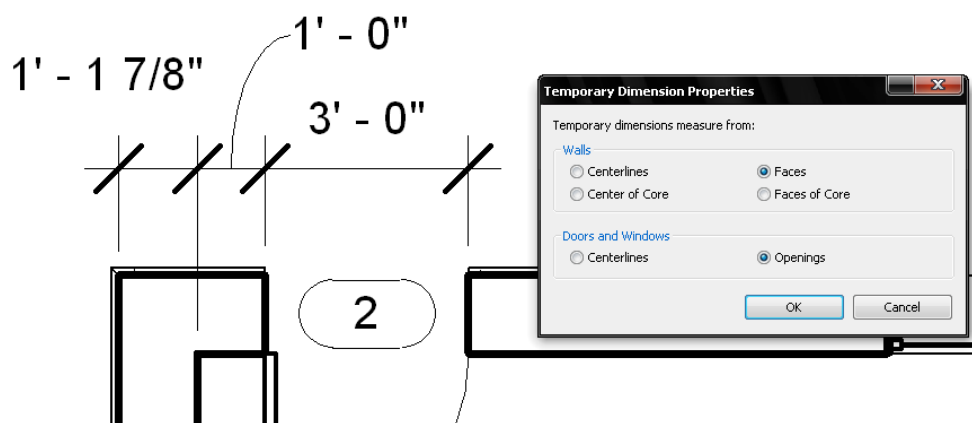
1. Dimensions and Constraints

Dimensions are elements which report sizes and distances in individual views. Dimensions show only in the view in which they were created although they may be duplicated when creating a new view from an existing view by selecting the Duplicate with Detailing option.

Constraints are non-view specific elements that allow you to create and lock in relationships between elements. Constraints may be defined with dimensions such as locked distances or equal values, or with other tools such as Align. Constraints defined with dimensions may be retained even when the associated dimensions are deleted.

There are two types of dimensions in Revit: Temporary and Permanent. Temporary dimensions appear as you are placing content or when an element is selected. Permanent dimensions are created by picking points or by converting a temporary dimension.

Temporary dimensions react by default with elements according to the values specified in the Temporary Dimension

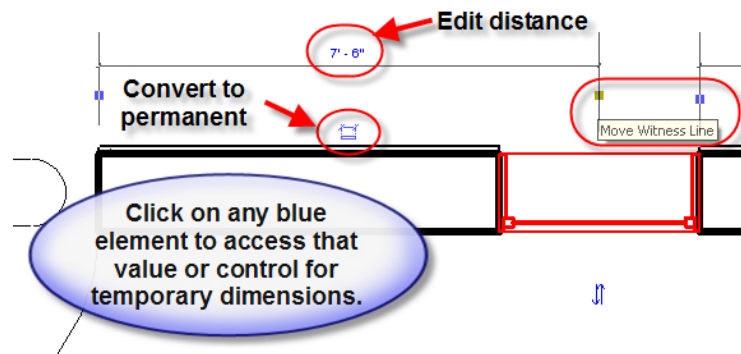


Properties dialog accessed from the Additional Settings pulldown on the Manage tab of the Ribbon.

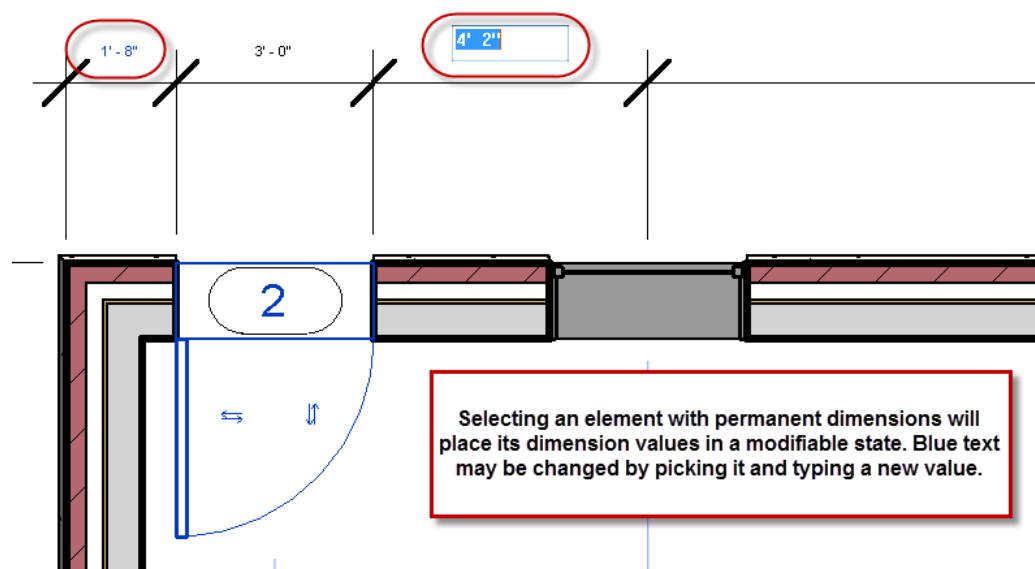
These settings can easily be overridden by moving the witness lines for temporary dimensions.

Selecting a component or element in the drawing will display the temporary dims for that element. If you pick the Dimension value, you can type in a new value and the selected object will move to reflect the new distance. If the witness line for the dim is not attached where you want it, you can move the witness line by picking the blue control box on the witness line, or by picking and dragging it to a new position. To convert a temporary dimension to a permanent one, pick the blue dimension symbol below the dimension.

Temporary dimensions display only when a single element is selected. It is possible to force the display of temporary dims for multiple objects by selecting 2 or more elements and then choosing Activate Dimensions on the Options bar. This will decrease performance.

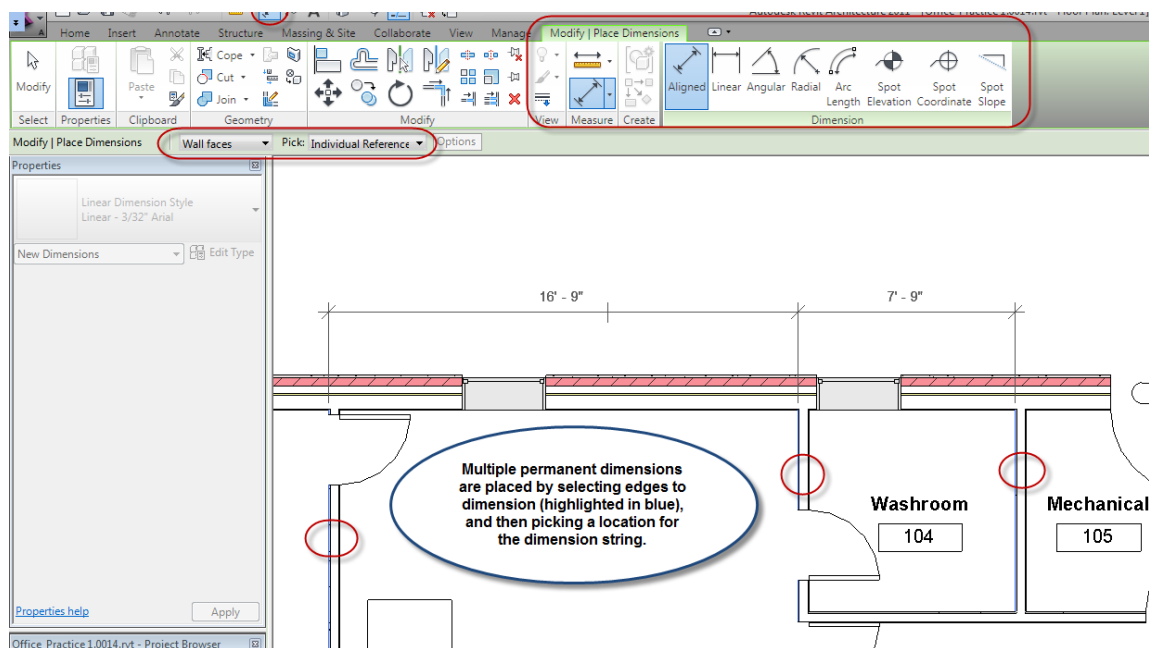


Permanent dimensions are specifically created or placed and may appear in a modifiable or non-modifiable state. To make a permanent dimension modifiable, select the geometry which it references. Values that can be changed will display in blue. Picking the blue text will highlight the value and let you change it. This will move the selected element.



LECTURE NOTES: CLASS 03

Permanent dimensions may be placed with the Dimension Tools accessed from the Quick Access toolbar, various tabs on the Ribbon, or with the keyboard shortcut, DI. On the Ribbon's dimension panel, found on the Annotate tab, select the type of dimension you wish to create: Aligned, Linear, Angular, Radial, or Arc Length. Next, on the Option Bar, set the Prefer pulldown option to Wall Faces, Wall Centre lines, Faces of Core, or Center of Core depending on where you want the witness lines to be placed. Set the Pick field to Individual References. Select each element face or center to dimension and then pick a point to set the dimension location.

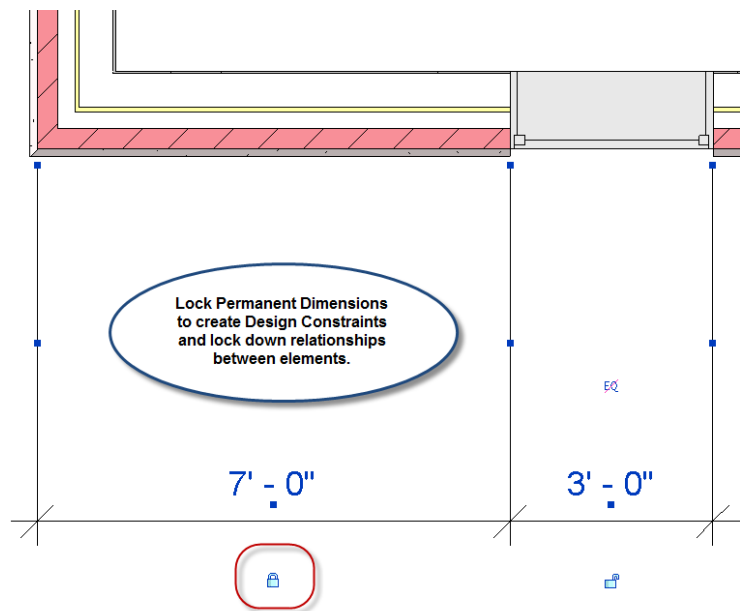


If more than one possible witness origin point is in the same area, you can toggle between them by floating your cursor over the area and pressing TAB until the desired origin reference is highlighted in a grey color, and then pick to select that reference.

Automatic Aligned Dimensions allow you to dimension one or more walls, including offsets, openings, intersecting walls, and intersecting grids in a single step. To create automatic dimensions, start the Dimension command and on the Options bar set the Prefer field as required, set the Pick field to Entire Walls, and then choose the Options button to set the Auto Dimension Options to enable dimensioning of openings, intersecting walls and / or intersecting grids as well as opening options such as Centers or Widths. Pick ok, select the wall or walls to dimension and then pick point for the Dimension location.

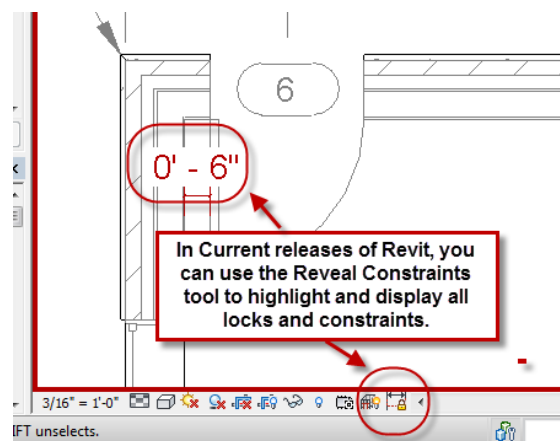
After you place any permanent linear or angular dimensions, a padlock icon will appear below each dimension segment. If you pick this symbol you can open and close the lock.

Locking a dimension segment will create a design constraint between the two elements which are being dimensioned, making it impossible to change the distance between those two elements without removing this constraint.



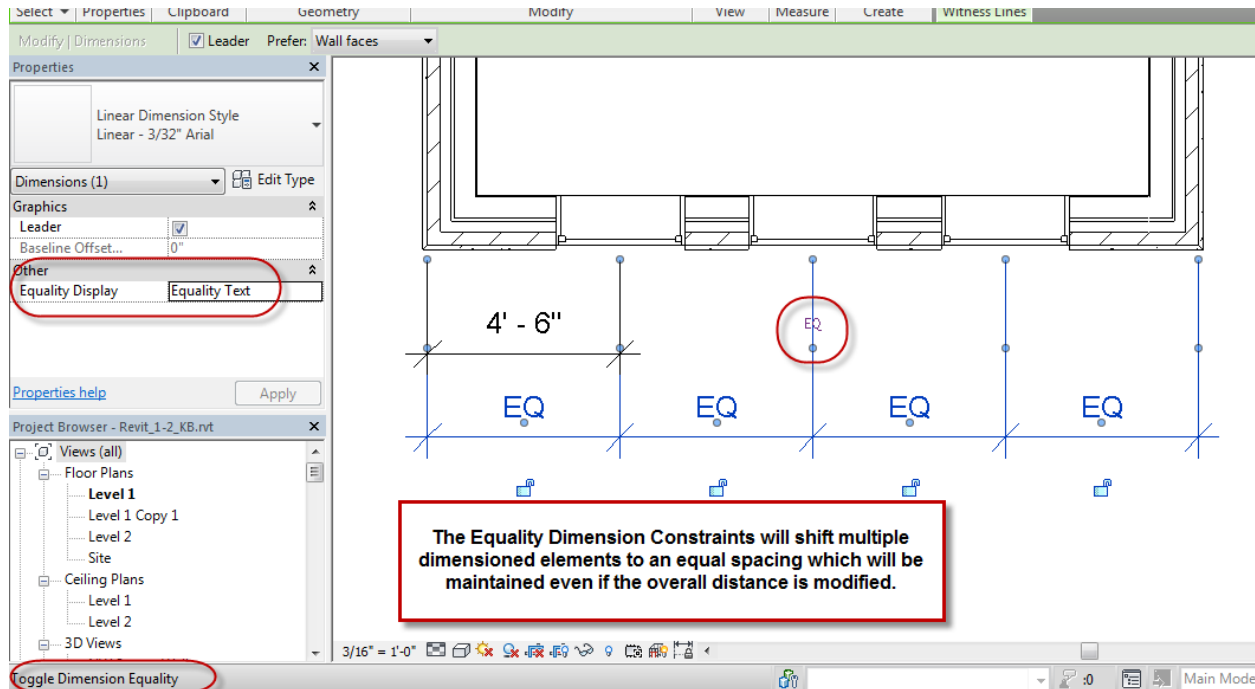
If you add a lock to a dimensioned element, it will create a constraint that can be retained even if you delete the dimension. This is not usually recommended as it can lead to an over-constrained model. If you select any constrained building element, it will display lock symbols and alignment lines to help show the source of the constraints.

In current versions of Revit, you can use the Reveal Constraints tool found on the view control bar to highlight all of the constraints in the model in red, even if the constraints have no visible associated dimensions.



It is not necessary or desirable to lock every dimension you create. Only add locks to critical dimensions where you need to establish a design relationship or you want to keep something from moving. The more constraints and locks you create, the more complex the project will become increasing the chance of design conflicts appearing while you work. Think of constraints as a temporary measure and delete them when you no longer need them.

A second type of constraint which may be created with dimensions is the Equality constraint which will appear as an EQ with a line through it when you create or select a multi-segmented dimension. Picking the EQ symbol will change all of the dimension values to EQ and will move all of the dimensioned elements so the distances between them are equal. This equality relationship will be maintained even when the overall distance changes.



If you assign equal constraints to a set of dims, but still want to display the actual dimension values instead of the EQ symbol, select the dimension, and in the Properties palette, set the Equality Display to value. It is possible to add a lock to a dimension that is also equally constrained.

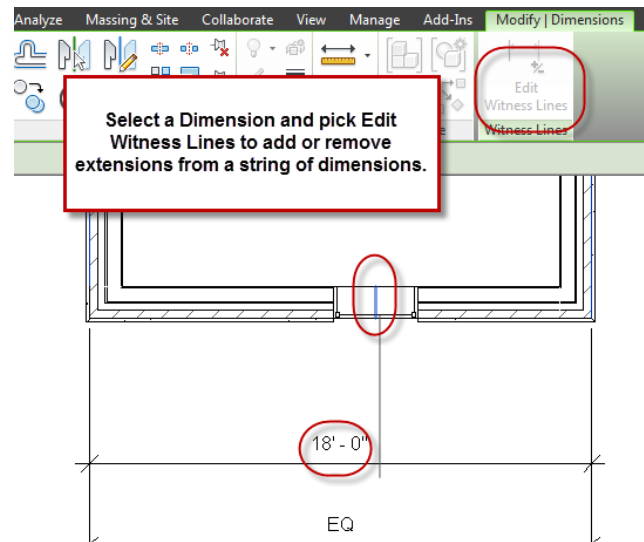
To remove equality constraints from a dimension, select the dimension and then pick the EQ symbol to toggle the equality constraint off. The equal spacing will be maintained unless the overall distance is modified.

Selecting a constrained object will display the constraint references as dashed lines. To hide the display of Constraints, type VG to open the Visibility / Graphic overrides dialog and in the Annotation Categories tab, clear the checkmark under visibility for the Constraints category

You can move a witness line for a permanent dimension by selecting the dimension and then picking or picking and dragging on the blue control box on the witness line. To change the Witness line gap for a dimension, pick and drag the blue control box at the end of the witness line.

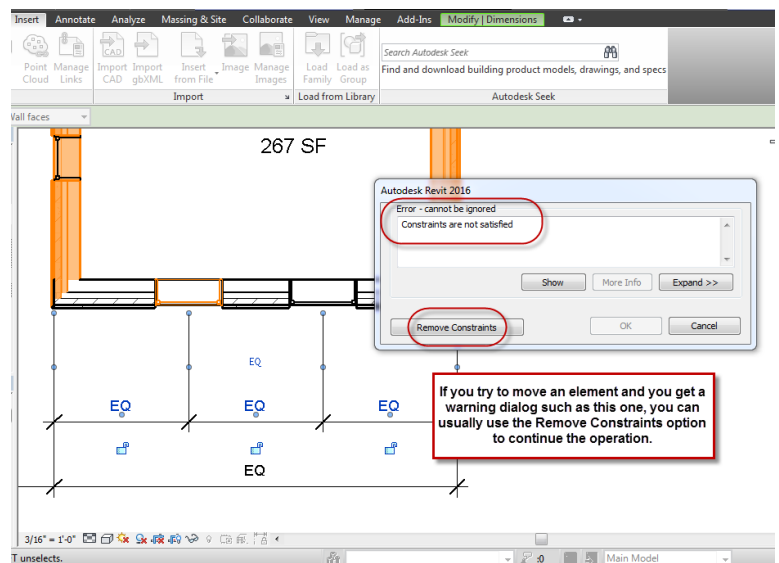
To add or delete witness lines from a dimension, select the dimension and on the Ribbon, choose Edit Witness Lines.

When you are Adding and Deleting Witness Lines, all of the reference points for the selected dimension will be shown in blue. Picking one of the blue lines will delete that witness line. To add a new witness line, select a new reference edge or point and a new blue line will appear along with the new witness line.



To reposition a dimension text value, select the dimension and then pick the blue control box below the text. On the Options bar you can choose to draw a leader from the text to the middle of the dimension line.

In current versions of Revit, it is possible to add additional text above, below, before, or after the default dimension text value. It is even possible to replace the true dimension text value with your own static text entry although this will generate a warning. To add text or replace the default dimension text, select a dimension and then pick one of the dim text values to open the Dimension Text dialog. Add or replace text elements as required and pick OK.



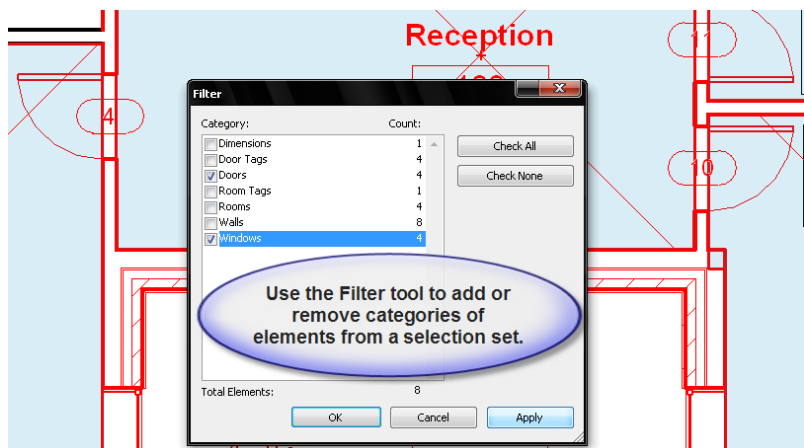
2. Selecting and Manipulating Content

Many of the methods used for editing an element are only available when an object is selected. To aid in selecting objects, Revit highlights objects when you float your mouse over them and a tooltip appears identifying the object that will be selected if you pick it.

If several items are in the same area, presses TAB to cycle the selection until the desired element is highlighted and then pick it to make the selection.

When you select an object, it will change color, any element specific editing controls and dimensions display on or near the element, applicable editing tools become available on the Modify panel or the Right-click menu, and the Selection Control in the Properties Palette will display the number of selected elements. The Ribbon will also show a "Modify_Element" tab with appropriate tools.

If you select multiple elements with a crossing or window selection and then pick the Filter icon from the Selection panel on the Ribbon, it will open the Filter dialog showing a list of all selected categories and the number of elements in each of those categories. Choose the Check None button to clear the list,



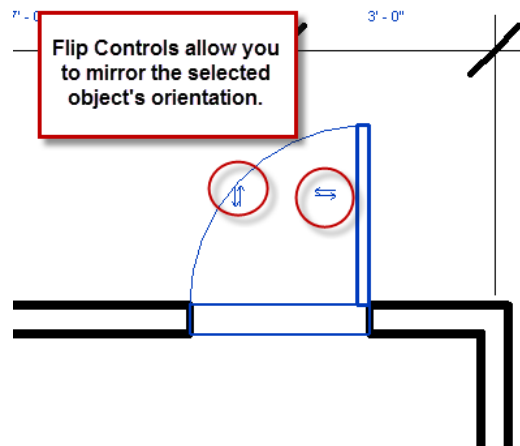
choose the categories you want and then pick OK to apply the current selection criteria and close the dialog box. Only elements in the filtered categories will remain in the selection set.

When multiple items are selected, you can also use the Selection Control window in the Properties palette to access the properties for any selected category.

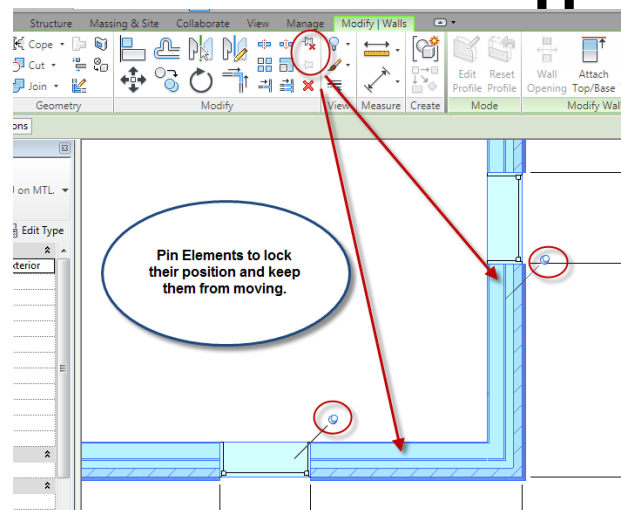
Create Chain selections of end-connected wall or line segments by highlighting an element and pressing TAB to highlight the entire chain. Pick to select all highlighted elements.

When you select an element, various controls and grips will appear on or near the element which may be used to move or resize it. Different types of controls appear for different elements and in different types of views. Drag controls appear as blue filled grips at the ends of lines and wall segments (in plan views). Picking and dragging these control points will change the endpoint location for the segments attached to that grip. In an elevation or 3D view, the controls display as arrows indicating Shape Handles which may be used to resize or reshape the selected element.

Flip Controls are double arrow icons which appear on some elements and are used to change the orientation of an element by mirroring its position. Flip controls are used to change the orientation of wall to flip the exterior side, to mirror a window within a wall, or to change the swing and hinge directions for a door.

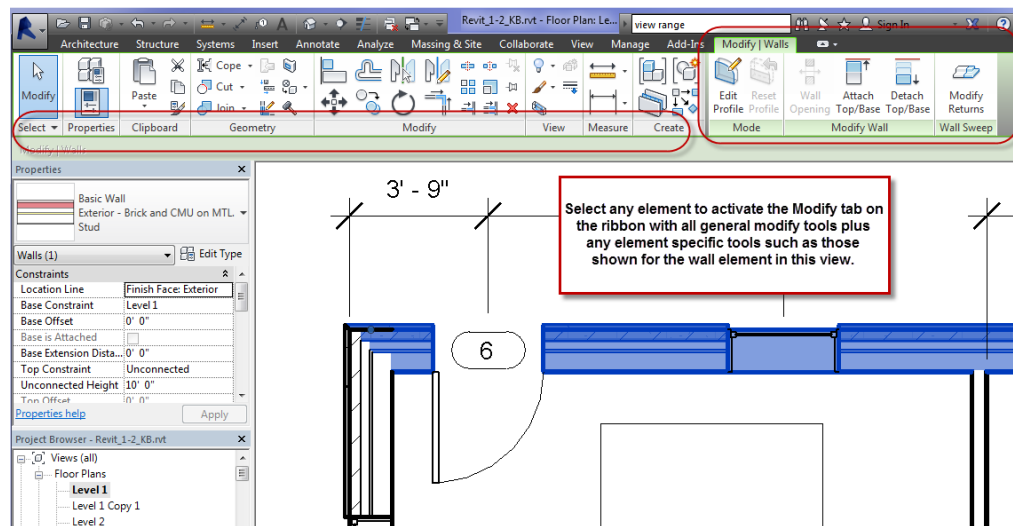


Pin Controls allow you to lock down an element to prevent it from moving. Pins do not constrain one element to another, but lock its position in space so it cannot be moved until it is Unpinned. To pin one or more elements, make the selection and pick the Pin tool from the Modify panel. You might want to Pin your structural grid or if you are doing an addition to an existing building, you could pin it down to ensure that it is not accidentally moved.

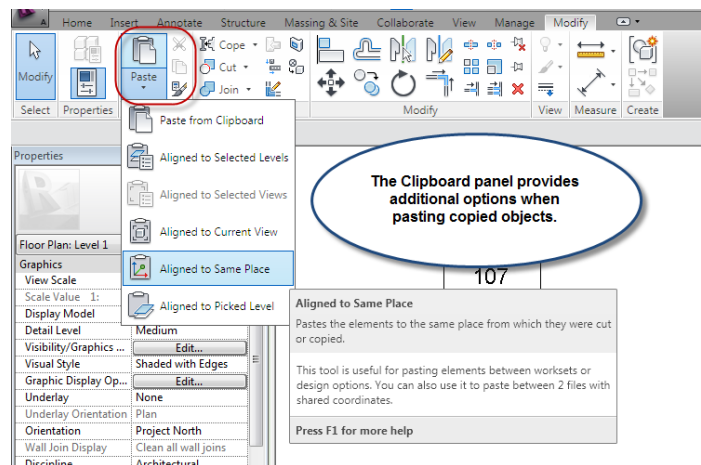


Use the Undo tool to cancel the most recent action. You can use the CTRL-Z keyboard shortcut or the Undo icon on the Standard toolbar. Selecting the dropdown arrow beside Undo tool allows you to undo multiple commands in single step. To Redo steps which have been Undone with the Undo command use the Redo tool, or Redo pulldown on the Standard toolbar. CTRL-Y will also Redo actions.

The Modify tab on the Ribbon provides access to a series of general tools for editing geometry, modifying elements, measuring and dimensioning, and creating parts, assemblies, and groups. The modify tab will automatically activate whenever you select one or more elements. You can also switch to the



Other familiar tools on the Modify|Element tab of the Ribbon include the Cut, Copy, and Paste commands which are used in many software programs to create duplicates of existing objects. The usual keyboard shortcuts, CTRL-C for Copy, CTRL-V for Paste, and CTRL-X for Cut work for these options. When you are pasting elements, look in the Paste dropdown menu for advanced options allowing you to paste the copied object into the same coordinates on one or more specific levels.



The cursor menu provides two options when an object is selected, that can be very useful including Create Similar and Select All Instances. Create Similar can also be accessed from the Ribbon or with the shortcut CS. Select All instances uses the shortcut SA.

The **Move** tool allows you to move objects with more precision than can be attained with the interactive pick and drag method of moving selected objects. Picking and dragging an object to define the move point makes it more difficult to specify precise dimensions for move displacements. The Move tool lets you use Object snaps such as endpoints, midpoints, etc. to precisely align one set of objects to other existing elements or references.

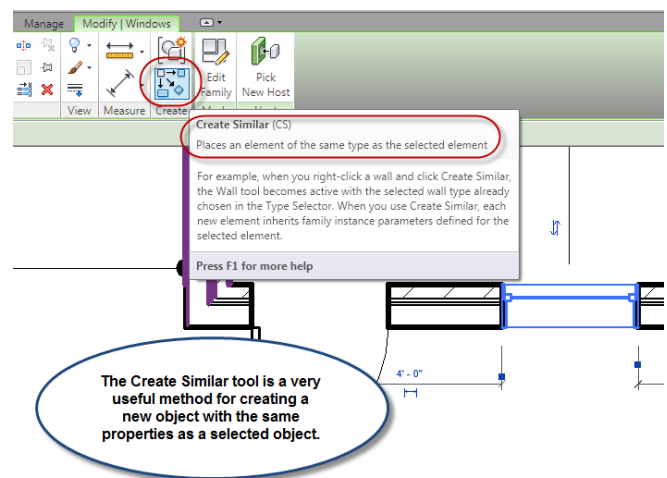
While moving objects the Options bar will show options for constraining the move in a single horizontal or vertical direction. (Ortho) as well as a Disjoin option and also a Copy option. Holding the Shift key will also constrain moves or copies to a horizontal or vertical direction.

Use the arrow keys to Nudge selected objects in small increments in a vertical or horizontal direction. The nudge distance will be dependent on the current zoom level.

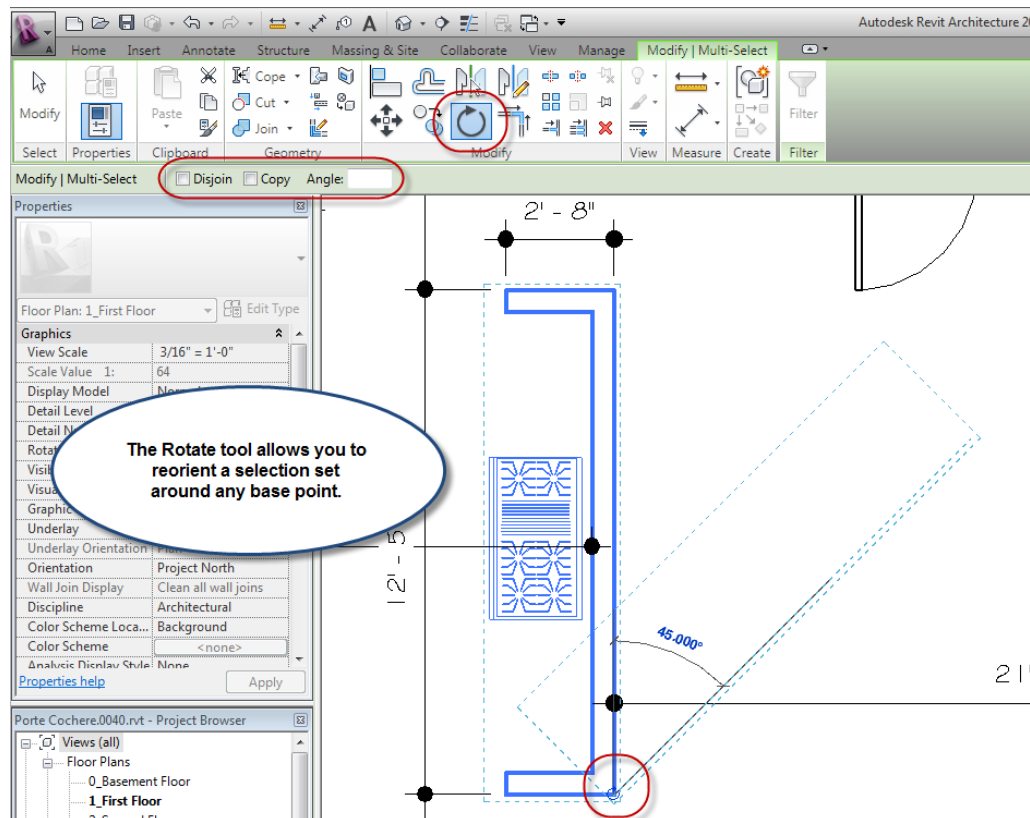
When you select certain elements such as furniture or other placed components, the Options bar will display a checkbox for *"Moves with Nearby Elements"*. If this option is enabled the selected elements will automatically maintain their relative position to nearby walls. Only elements with edges which are parallel to a wall will be affected by this option.

The **Copy** tool is very similar in function to the Move tool. It does not use the windows clipboard and is used to create copies in the current view only. If you want to create more than one copy at a time, choose the *Multiple* option on the Options bar. The Copy tool does not allow you to copy a hosted element such as a door or window to a different host wall.

The **Create Similar** is another useful method for creating a copy of a selected element. This tool is available for most Revit Architectural elements and allows you to place a copy of a hosted element outside the original host. For example a door may be "copied" to an adjacent wall. The Create Similar tool copies the general Type parameters for an element, but does not copy specific, instance parameters such as unconnected wall heights for a wall element.



Elements may be Rotated precisely with the Rotate tool on the modify panel. The default rotation base point will be defined at the centre of the selected elements but you can pick and drag the rotation origin symbol to any location to act as the base point. You can then define the rotation angle by picking two points or by typing in an Angle value on the Options bar.

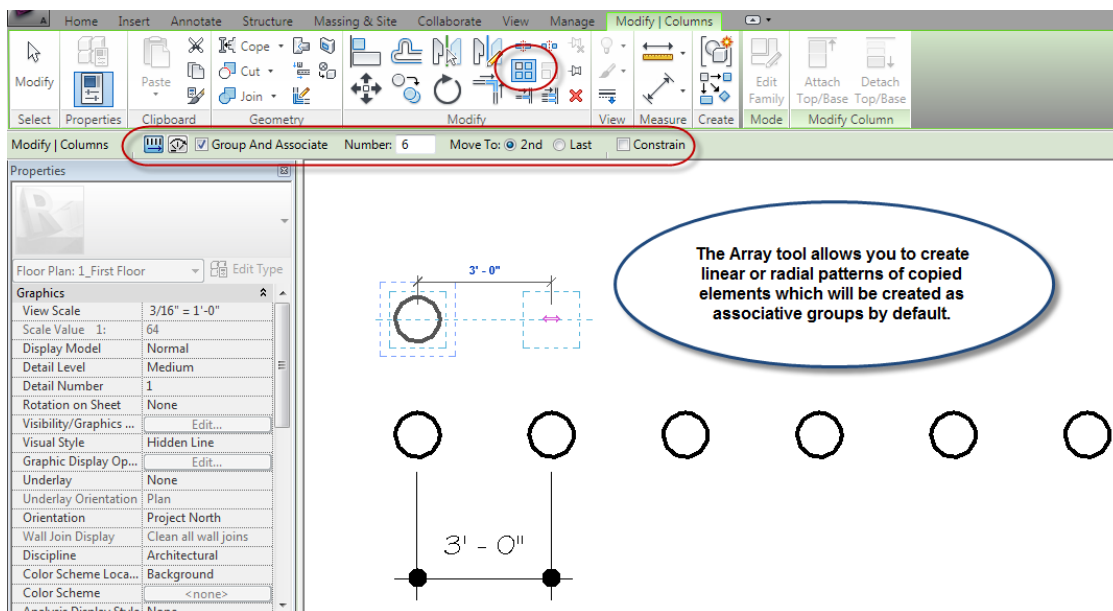


The Space bar may be used to Rotate elements as you are adding them and also after they have been placed. Selecting a door or window and pressing the Space bar will Flip the element through its available options. The Space bar may also be used to Flip the orientation of a wall. Selected components will be rotated in 90 degree increments.

The **Mirror** tool is another useful option on the Modify panel which allows you to create a reflected copy of one or more elements across an axis. The Mirror axis may be defined by selecting an existing edge or center reference in another element such as a door, window, wall, etc. or by selecting the Draw tool on the Options bar, you can pick two points to define the axis. If you do not wish to retain the original object, clear the Copy checkbox on the Options toolbar.

The **Array** tool allows you to create multiple copies of one or more elements in either a linear or a radial pattern. Arrays may be defined by specifying a number of elements in the array and a distance or angle between elements or an overall distance or angle to fill. To specify an incremental distance, choose the Move to 2nd option. To specify a total distance or angle to fill, choose the Move To Last. Both settings are found on the Options bar.

When you create an array, by default, the Group and Associate option will be selected. This option will create a relationship between the arrayed objects which can be modified after the array has been created. A grouped linear array will have a parameter for the number of elements in the array.



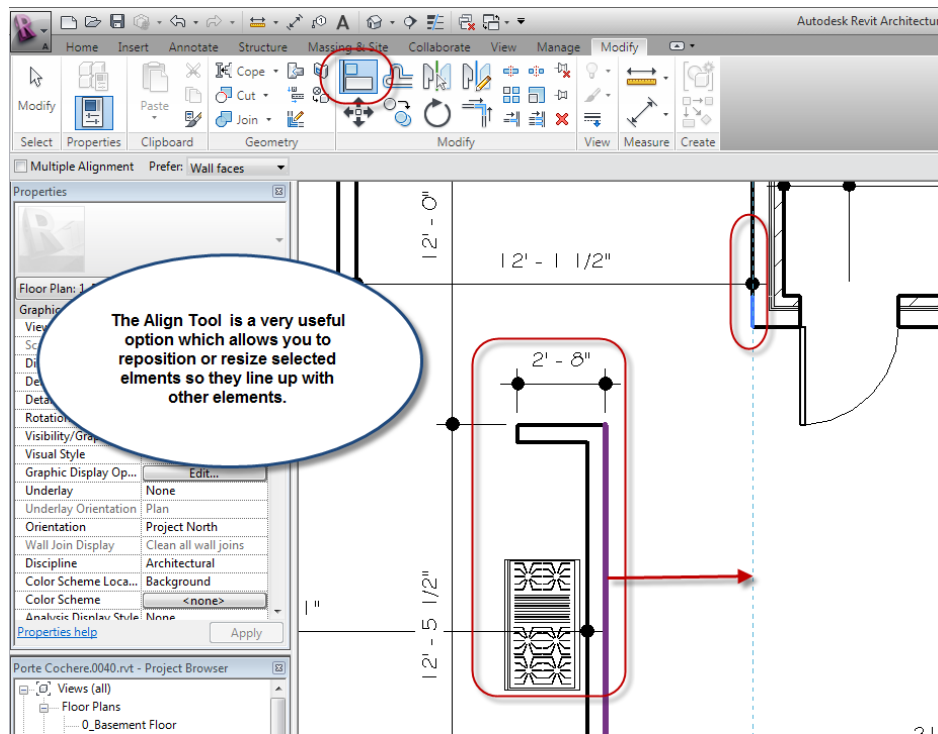
Radial Grouped arrays offer even more controls including the number of elements in the array, the angle between elements, the total angle to fill with elements, and the radius of the curve for the array.

Moving an element in a grouped linear array can resize the entire array. If the arrayed element is not hosted, dragging and element can also reorient the array of objects.

If you delete an element from an array, you will no longer have access to the parameter for the number of elements in the array and it will break the array into a series of model groups with one element in each group.

3. Editing Tools

The **Align** command on the Modify panel is an extremely powerful and useful feature which allows you to move elements against or in line with each other. After moving objects into alignment, a Padlock icon will appear, optionally allowing you to create a constraint between the elements. If constrained, when one element is moved, it will drag the aligned element along with it.



Unlike the previous editing tools, when you use the Align tool, you first choose the object you are aligning TO and then you select the object to move. When you choose the alignment references, Revit will automatically determine the center or face of elements in most cases.

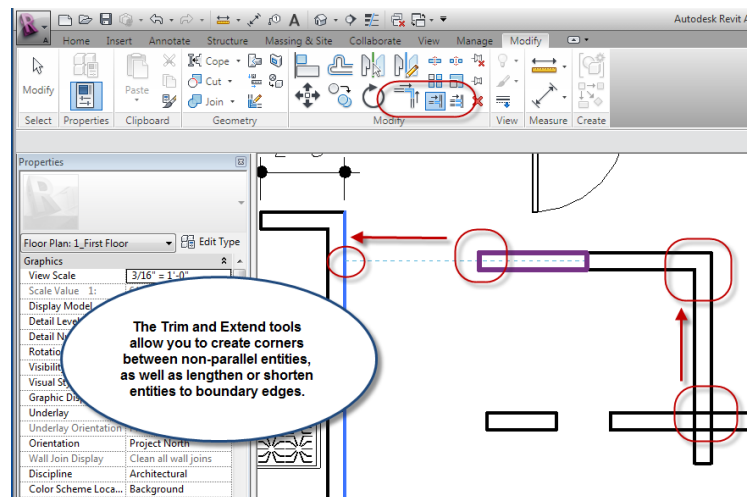
When aligning objects to walls, the Options bar will display an option to Prefer. Wall Faces, Wall Centrelines, the Face of the Structural Core or the Core Centreline.

The **Align** tool may be used to align surface patterns such as tiles or bricks with existing elements. Tile patterns for example may be aligned to coincide with a selected wall. The keyboard shortcut for Align is AL.

The **Trim** tool allows you to Trim or Extend one or more elements. As with the Align command, you first select the tool and then you select the objects to which you wish to apply the tool. When you select an object, the Modify panel on the ribbon will display three Trim tools: Trim Extend to Corner, Trim Extend Single element and Trim Extend Multiple Elements.

The trim extend to corner allows you to create a clean, closed corner from two non-parallel elements such as walls or lines. When you trim to a corner, pick both elements on the side you wish to retain.

The Trim Extend Single and Multiple options allow you to choose first a trim/extend boundary and then the element you wish to trim or extend. When you select the second element, Revit will display a blue dashed line to indicate the result of the operation.



The Extend options will be obvious but if you are familiar with the AutoCAD Trim command, the trim operation may seem unusual. Unlike AutoCAD where you select the boundary and then choose the portion to remove or trim off, Revit asks you to specify the boundary and then the portion you wish to retain.

The **Split** tool allows you to break a wall or line at a selected point. If you choose the option to “Delete Inner Segment” on the Options bar, Revit will prompt you to select two points along the wall or line and will trim out and remove the portion between those points. Split with Gap allows you to preset a gap size of up to 12 inches to create with a single pick. To combine two wall segment after splitting, pick one wall and then drag the control grip over the endpoint of the second segment.

The **Offset** command allows you to move or copy elements in a concentric or parallel manner. The offset distance may be specified on the Options bar or, if you choose the Graphical setting, you can specify two points to define the offset distance after first selecting the object to offset. To offset an entire chain of elements, highlight the first element, press TAB and then pick to offset the entire chain.

Exercise Notes

In the following exercise you will learn how to apply dimensions and constraints to your preliminary model to practice how to define relationships between elements. You will also practice manipulating elements with various editing tools and control features.

1. Open the project you were working on in lesson 2. If level one is not active, double click this level in the Project Browser to make it current. Type ZF to Zoom the view to Fit.
2. Start by defining the overall dimensions for the building footprint and locking them. From the Quick Access Toolbar, choose the Dimension tool. On the Options bar, choose Wall Faces and Pick Individual References. Select the face of the brick component on the lower, horizontal wall on the left side and then the same face on the horizontal wall at the top of the plan. Note that the face of the brick is not the outermost line in the wall but actually is the second edge in towards the interior. This is because we are using a complex wall style with a sill element between the block on the lower section of wall and the brick on the upper section of wall.(If you switch into the default 3D view and zoom in on a corner of the building, you can confirm the presence of this element.) While you are adding dimensions, use the wheel on your mouse to zoom in and out as required. After you select the two brick faces, drag your cursor away from the building and pick a point to locate the Dimension.
3. After you place the dimension, the dim value will appear in blue and a padlock icon will appear below the dimension. The dim value should be 38 feet, but if not exactly that value you can select one the walls and then change it.
4. Pick the wall at the front of the building and the dimension value should highlight in blue. If it doesn't highlight automatically, select the Activate Dimensions button on the Options Bar and it should change color. Pick the blue dimension value and it will highlight in a field where you can type a new value. Set the distance to 42 and hit enter. The wall will move, remain selected, and the dim value will still be blue. Take note of the square footage shown on the Room Tag in the adjacent office. Pick the dim value again and change it to 39 and hit enter. The wall will move again and the square footage shown will automatically update.

5. When a dimension runs between two objects and you change the dimension value, the selected element will be the one that moves to reflect the new distance. Hit ESC twice to clear the current selection and pick the other dimensioned wall at the back of the building. If the dimension text does not turn blue, it cannot be modified and you will need to choose the Activate dimensions button on the Options Bar. When dim text is editable, change the value to 44 and hit enter. This time, the wall at the back of the building will be the one that moves. Pick the dim text again and change it to 42 to pull the wall back down.
6. When you add a dimension, a dimension lock icon will appear allowing you to lock the dimension value right away. If you need to manipulate the dimensioned element as we have just done, to move it to the correct distance, the lock will not appear until you select the dimension. With the wall still highlighted, pick the dimension, to switch the selection and then pick the lock icon below the dimension to toggle it on and lock the value.
7. Pick the dimensioned wall at the back of the building and if no dims appear, choose Activate Dimensions. The 42 foot dimension will remain black indicating it cannot be modified. Select the wall at the front of the building and try the same thing. The 42 foot dimension cannot be changed.
8. Add a second dimension between the inner face of the front wall and the closest face on the wall at the North side of the office. Select the front wall and change the value of the highlighted dim to 16. Since the exterior wall is selected, it does move to make the office length 16 feet, but because the back wall is locked at a distance of 42 feet, it is also shifted to maintain this distance. With the wall still selected, change the value to 14 and then back to 16 and watch how the front and back exterior walls shift back and.
9. Add third dimension between the front exterior wall and the inset exterior wall containing the front door. Position the dim to the left of the front door but do not lock it.
10. We want to keep the 16 foot office, but we also want to change the dimension by the front door to a reasonable value. Perhaps, 8'-0". The solution is to remember that the wall you select will be the one that moves when you change the dim value. If we select the wall that is hosting the front door, it will move and the office dimension will be maintained. Try it now. Pick the wall with the door, activate its dimensions, and change the value to 8 and hit enter. Change it to 10 and hit enter again to see that only the selected wall is moving. Hit CTRL-Z twice to Undo two steps and revert to the original dimension.

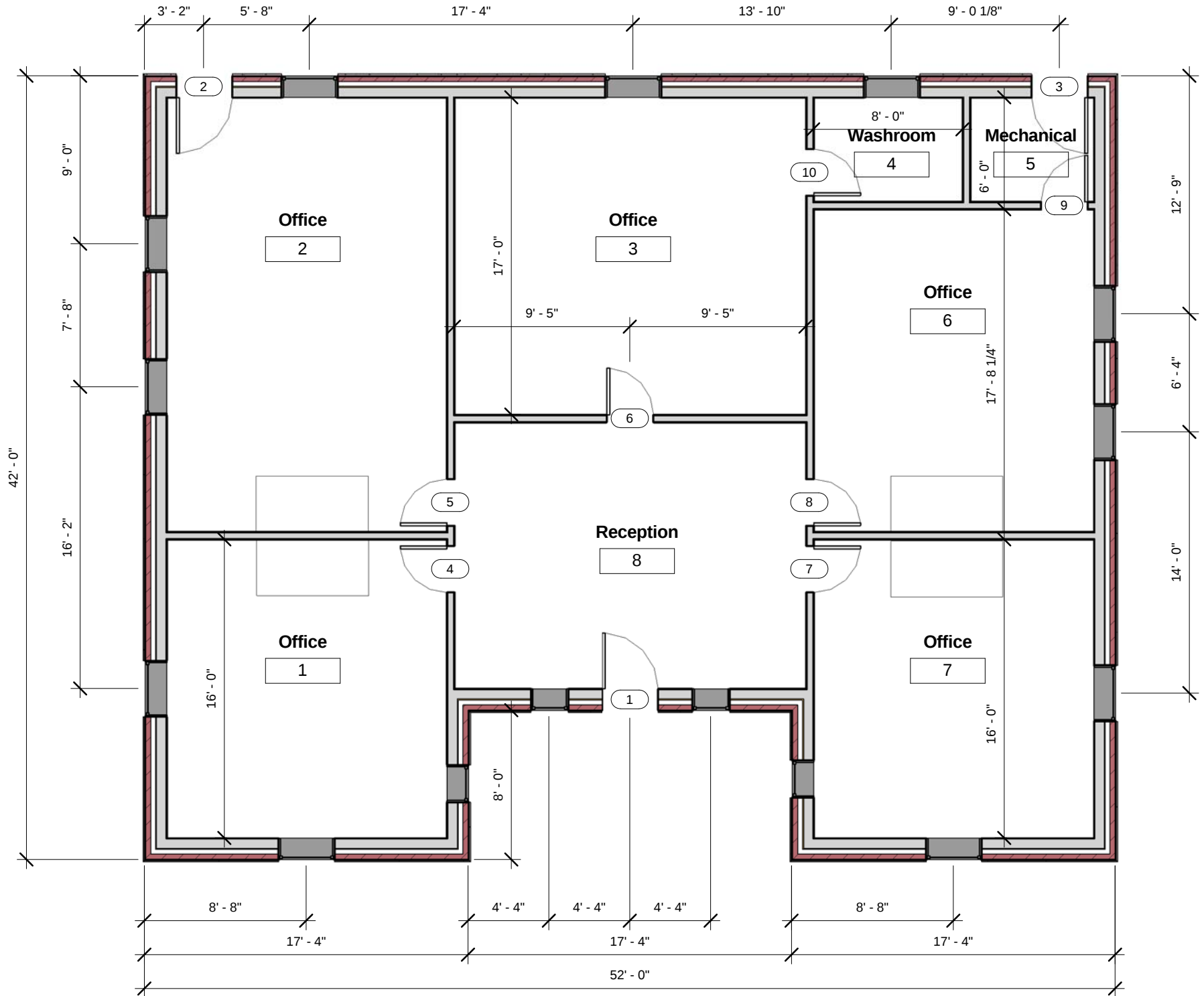
11. To see what can happen when you don't think about what is selected and what is constrained to other elements, let's try it the wrong way. ☺ During this exercise, if any warning boxes appear telling you that an insert conflicts with a wall, just click in the drawing area to close the warning. (It happens if the end of a wall runs into a door opening.)
12. Pick the bottom exterior wall, and change the dim value to the front door wall to 8 feet. It moves the exterior wall so the distance to the front door wall is the correct 8 feet, but the office is now the wrong size.
13. Pick the same exterior wall to activate its dimensions again. This time pick the office dimension and change its value back to 16. Now, we lose the 8 foot dim. Okay. We'll lock the 8 foot dim first. CTRL-Z to get the 8 foot dim back. Pick the dim and lock it.
14. Pick the exterior wall at the bottom of the office and activate the dimensions. Change the office dimension to 16 again. Because the exterior wall is the one selected, and two other exterior walls have a locked dimension to the selected wall, the entire building shifts up to resize that office! I think you'll agree, the way we did this back in step 10, when we planned it, worked much better.
15. At this point, it is very likely that the shifting around of walls has created a conflict between some of the walls and one or more doors or windows. These are easy to fix by picking and dragging the door or window away from the conflicting wall. (or vice versa depending upon what is already dimensioned and locked or constrained. You should be able to select an element, hold down your mouse button, and drag it to a new position all in one step. Be careful as sometimes this option will lead to inadvertent moves when you select objects.
16. Select the 16 foot dimension inside the office and lock it. If any doors or windows around the office are conflicting with walls, move them by picking and dragging them to the correct location.
17. Take a look at the doors and windows around the office. Are all of the windows oriented to the same side of the wall? Pick one of the windows to select it. Pick the blue, Flip arrows which appear on one side of the window to change the side of the wall on which the window is placed. With the window selected, press the Space bar and it will also flip the window. Ensure all of the windows are oriented to the outside face of the exterior wall.
18. Try picking the door to the office and toggling the orientation of the door through its four possible Swing and Hinge configurations. You can do this either by picking the two sets of blue flip arrows, or by selecting the door and repeatedly pressing the space bar. When the door is in the correct direction, opening into the office and against the north wall, zoom in to the door.

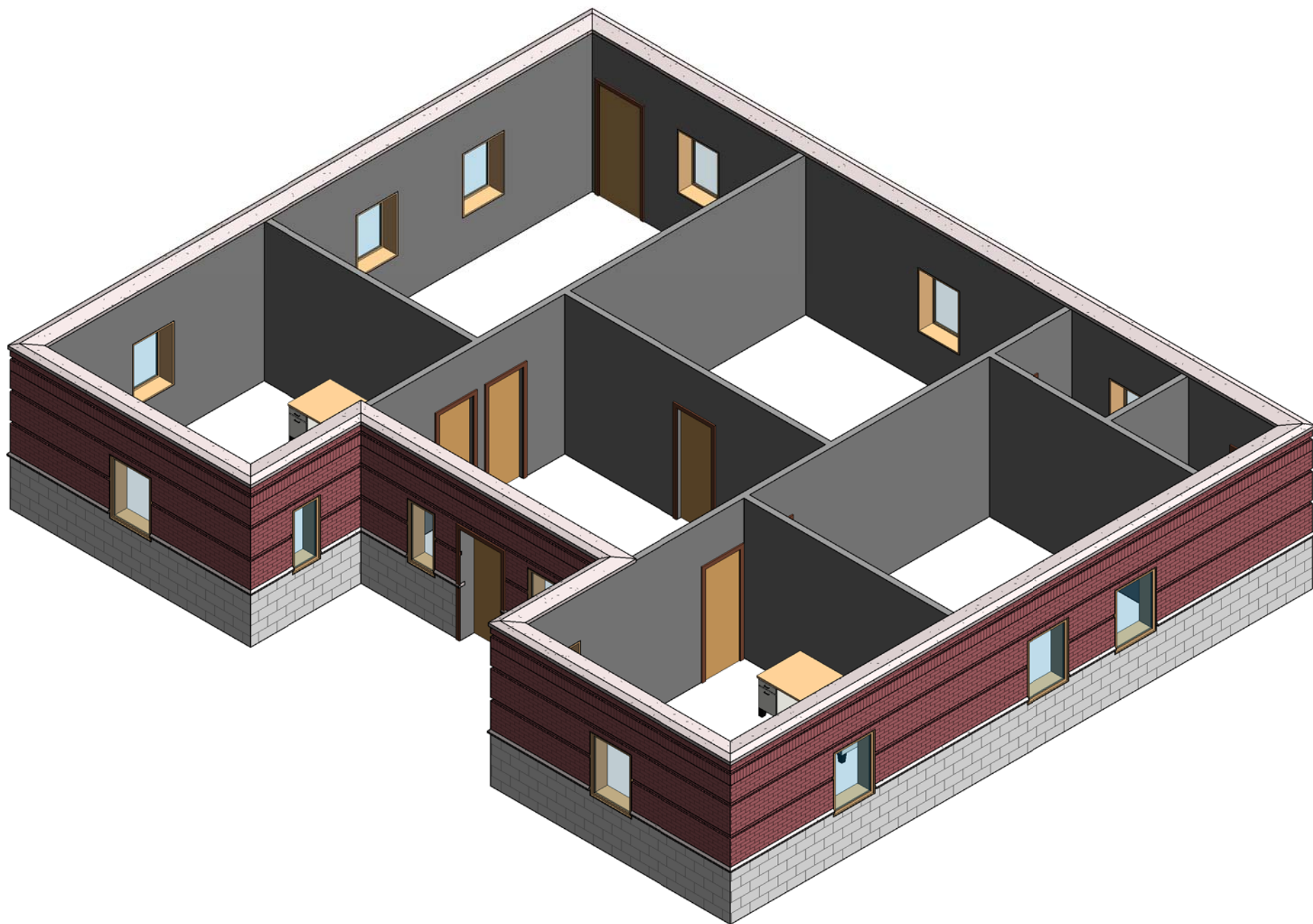
19. Pick the door and then pick the witness line control bar on the temporary dimension at the top of the door to toggle the witness line location between the centre and the face of the opening. Toggle the witness line at the wall to the face closest to the door. Pick the dim value and change it to 4". Make sure you type the "mark to indicate inches, as just a number 4 will indicate 4 feet with the default unit settings.
20. To lock this relationship between the door and the adjacent wall, add a permanent dimension and lock it. As soon it is locked, hit the Delete key and a warning dialog will appear indicating you are deleting a constrained dimension. Pick OK to finish the delete operation but still retain the 4 inch offset constraint between the door and the wall. This method will allow you to create dimensional constraints in a number of locations in the design but only display an actual dimension in one location.
21. To see how the door will move with the wall, unlock the 16 foot dimension inside the office, and reposition the interior wall by picking it and dragging it to the North. The door will move with the selected wall to maintain the 4 inch dimension. When you pick the wall, it will display a dashed line and a lock symbol to indicate the constraint between the door and the wall. Set the dimension back to 16 feet and then lock it again. With nothing selected, pick the Reveal Constraints tool on the View control bar. Red dimensions will appear wherever constraints have been added. Toggle the Reveal constraints back off.
22. So far, our building has been able to shift its exterior walls to reposition or resize the building perimeter without regard to a fixed location. Locking the position of your building to keep it at a certain location can be done with the Pin tool. If we were first creating a structural grid for this building, we could Pin the grid and then constrain the walls to the grid. In this example we don't have a structural grid, but we can still lock the building down and anchor its position by Pinning one of the exterior walls. Select the 42 foot wall which we dimensioned first. On the Edit toolbar choose the Pin tool. Repeat for the adjacent exterior wall at the front of the building. This corner of the building is now locked down and the walls will no longer move. If you select either of the pinned walls you will see that the Activate dimensions button is no longer available. If you try to move the walls by picking and dragging, you'll see that they no longer respond.

23. Toggle the Reveal Constraints tool again. No symbols appear that are related to the Pinned walls. Pins are different than constraints. Pins will not only keep you from moving an element, they can also restrict the types of edits that can be applied to an element. No more than one Pin should be added to a project. Select the front wall and pick the Pin icon to unpin it. After you Pin an object, even if you Unpin it, the pin icon remains. To get rid of it, delete the once-pinned object, and then hit CTRL-Z to undo and bring it back. The pin icon will be gone.
24. Zoom in around the front of the building on the left side. Type DI to access the Dimension tool and then pick the left face of the building, the centre of the window, and then the outside face of the next exterior wall to create a multi-segmented dimension locating the window relative to the walls on either side. Pick a point to place the dimension below the exterior wall and then pick the EQ equality symbol to toggle the equality constraint on. The window will reposition to the exact centre of the wall in which it is hosted and the dimension values will change to EQ.
25. Add a single dimension to show the overall length of the wall hosting the window. Select the short exterior wall on the right side to enable the dimension value for the newly created dimension. Change the value to 15 and then again to 17 and watch how the window continues to shift to maintain its position in the middle of the wall.
26. Zoom out so you can see the width of the building. Pick the last dimension you created and on the Options Bar choose Edit Witness lines. Each of the existing witness lines will highlight and a new witness line will appear attached to your cursor. Pick the outer faces of each of the remaining exterior vertical walls to change the single dimension to a multi-segmented dimension showing the widths of each of the three sections of the building. After the last witness line has been added, pick in an empty area to complete the operation. (Do not cancel or hit escape to finish or the witness lines will be removed.) Pick the Equality symbol to modify the width of the three sections to the same distance.
27. Draw an overall dimension showing the entire width of the building. Pick the main exterior wall on the right side of the building so you can modify the overall building width with the last dimension created. Set the dimension value to 58. Change it to 54 and then to 52. Note how each of the three sections of the building shift to maintain their equality and as the individual sections change width, the equally constrained window also moves at the same time to maintain its own centered position in the wall.

28. After using equality constraints, you have a few choices as to how to deal with them since you probably don't want too many EQ values showing instead of actual dimension values. Also, where we are showing an overall dimension we do not want to show all of the incremental dimensions as well. The last dimension in a string is left out as the value can be calculated by subtracting the other increments from the overall value. If you wish to maintain the actual Equality constraint but not show all of the dimensions, delete the dimension but retain the constraints as we did with the four inch door opening offset. After deleting the Equal dimensions, draw new dimensions to show the distances where required. The other option is to toggle the equality constraint off after moving the objects and then edit the witness lines to remove the last witness line in the string.
29. If you remove equality constraints, and wish to keep the elements from moving, lock the dimensions by picking them and toggling their lock icons.
30. Create a set of equality constraints between the front door, the two adjacent windows, and the adjacent exterior wall faces.
31. Zoom around the front section of the building so you can see the horizontal walls along the South side. Type AL or pick the Align tool from the Tools toolbar. Pick the exterior face of the lower exterior wall on the left side to define the "Align To" reference. Pick the exterior face of the lower exterior wall on the right side of the building and it will shift down to perfectly align with the first wall. A dashed line and a lock icon will appear allowing you to create a locked alignment constraint by picking the lock. Repeat the process with the office walls to make the lower offices on both sides of the building, the same size.
32. Another useful place to create alignments is between the faces of interior walls and exterior walls such as at the intersection of the two, main North/South interior partitions and the exterior walls on either side of the front door. It is likely that even if they were initially drawn in the correct alignment, the resizing of the building has changed their locations. Zoom in to the connection between the interior partition and the exterior wall. Type AL and pick the inside face of the vertical exterior wall and then the corresponding face on the interior partition. Lock the alignment. This type of lock alignment can even be added when the two elements are already aligned. Create the constraint with both North South walls.

33. Add 4" door offset constraints to the remaining interior doors. Continue to constrain and dimension the remaining elements, moving them into the positions shown on the lesson handout drawing.
34. After all dimensions are in place, pick and drag the room tags into the middle of the rooms. As the tags are repositioned use the Smart Alignment lines (dashed green lines) to align the tags between rooms. These lines will appear when moving many types of elements.
35. Save and close the Project file. Don't forget to back up your work to a removable disk for safekeeping. We will continue with this project in the next lesson.





AGENDA:

1. Categories, Families, Types and Instances
2. Family Libraries and Loading Families
3. Introduction to Sketching and Sketched Features

1. Categories, Families, Types, and Instances

In Revit, there are three major types of elements – Model Elements such as walls and doors, Datum elements such as levels and grids, and View specific elements such as Dimensions. Elements are classified by their Category, Family, Type, and Instance.

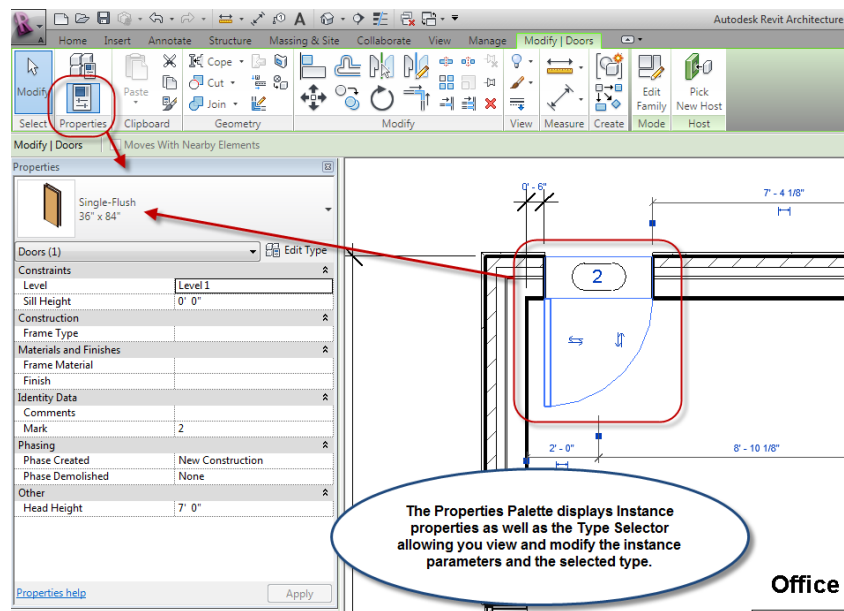
- **Category** - Categories are major classifications of elements used to design or document the building. Examples include Walls, Floors, Windows, and Room Tags.
- **Family** – Families are classes of elements in a category. Families group elements with a common set of properties, usage, or similar graphics. For example in the Door Category, you might have a Single-Flush Door family, A Bifold Door family, and a Sectional Overhead Door family.
- **Type** – Each family can have one or more types defined. A type is usually created to represent different sizes of an element. For example a double hung window family might have 3 predefined types for 24x48 inch, 30x48 inch, and 36x60 inch openings. By choosing a specific type you can quickly set two different dimensions for that element. Additional types may easily be created as required.
- **Instance** – Instances are the individual items that are placed in the project. An instance will always have a specific location within the building or on a drawing sheet depending on whether it is a model instance or an annotation instance. Individual instances may have specific parameters which can vary from one location to another.

The element properties palette allows you to view and modify the properties that define the behavior and appearance of elements in a project. The element properties content will vary with the Category of the selected element and also with the Family of the element.

All properties in a family are defined as either Type parameters or Instance parameters. When you modify a Type parameter it will automatically be applied to all instances of that type within the project. A change to a Type parameter will also affect all subsequent instances of that type that are added to the Project.

An instance parameter will affect only objects of the same type, in the current selection. Multiple objects may have their common instance parameters modified simultaneously.

The Element Properties palette allows you to view and modify the properties for an object that is being created or is currently selected. The Properties palette is displayed above the Project Browser by default but can be toggled off and on with the Properties tool from the Modify tab of the Ribbon or with the keyboard shortcut, PP.



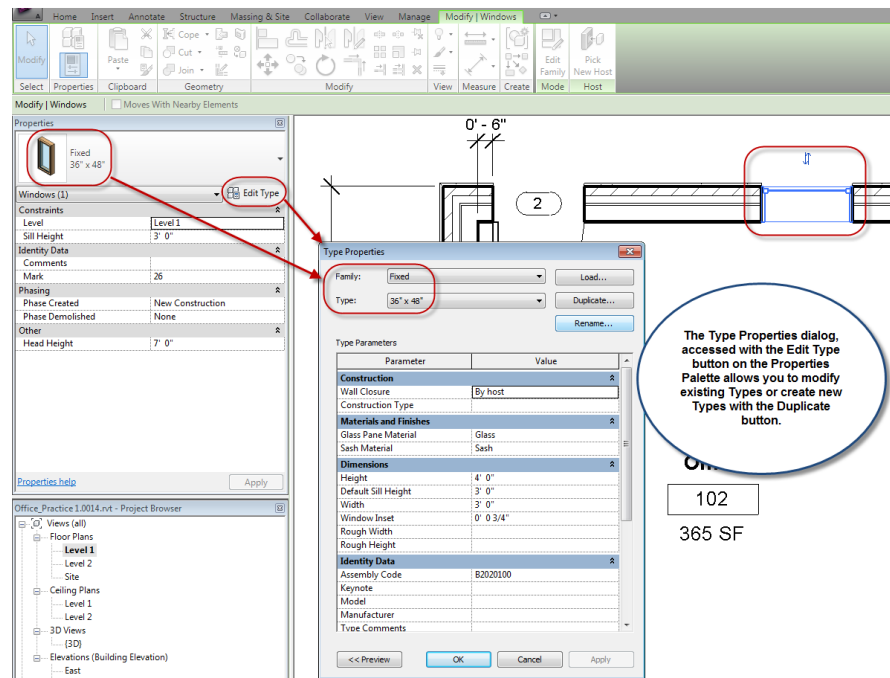
The Element Properties palette displays the current category and the current family type within two pulldown windows at the top of the palette. The family type may be modified by choosing an available option within the Type selector. The Instance Parameters section displays all of the parameters that will be applied only to the selected instance. If you have multiple objects selected, only the instance parameters that are common to all selected objects will be displayed. Changing a value will apply to the entire selection set.

To view or modify the Type parameters, choose the Edit Type tool below the Type Selector.

The Type Properties dialog displays all of the parameters that will apply to all instances of the selected element allowing you to view and make changes to the Type. Any changes you make to a Type Parameter will affect every instance of that type in the Project.

New types may be defined by duplicating an existing type, naming the new type, and then setting the Type Parameters to be applied to all instances of the new type. This is a very useful method to use when the desired size of an element is not initially available.

To make a new Type from an existing element type without modifying any instances of the existing type, access the Element properties for the existing Type, choose Edit Type and then pick Duplicate. Specify a new, descriptive name for the type, and modify the parameters as required. To preview the new type, select the



Preview button to open a view window where you can select a viewing direction and use a steering wheel to adjust the view. Pick Ok to apply the changes and close the Type Properties dialog.

If you do want to change the parameters for an existing type, and you want all of the existing instances of that type to be updated with the new parameters, follow the above procedure, but choose Rename instead of Duplicate. All of the existing instances will be renamed and all modified parameters will be applied.

2. Family Libraries and Loading Families

All elements in Revit Architecture belong to families. Each Family may have multiple types predefined and new types may be created by duplicating existing types. When you start a new project, the Families which are available for use will be determined by the template used to start the Project.

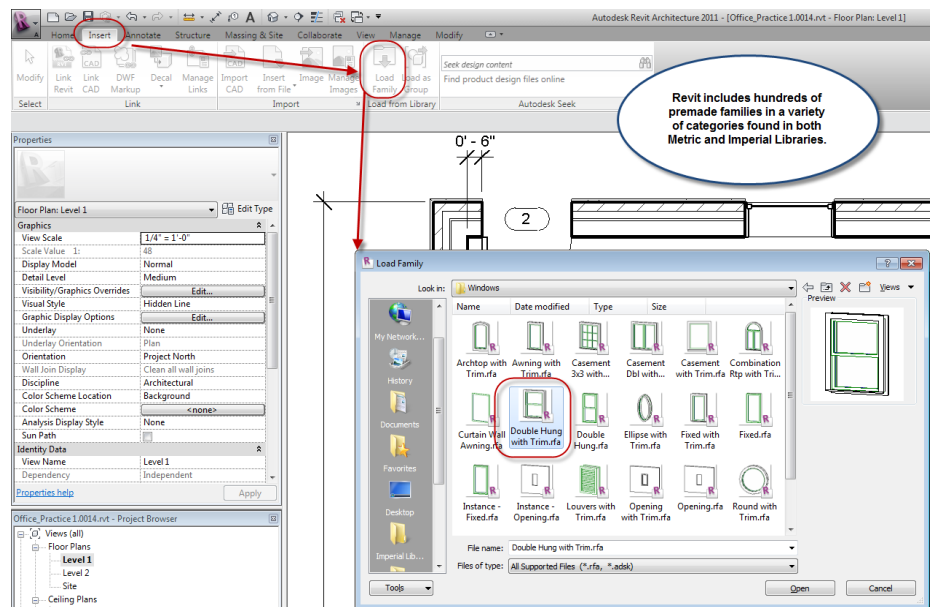
There are two general categories of Families: System Families are Host elements such as Walls, Roofs, Floors, Stairs, etc. and these system families will always be available. Variations of System families are defined by creating new Types. The other category of Families are hosted elements such as doors, windows, railings, etc and placed elements such as furniture, plumbing fixtures, annotation elements etc.

Families are defined with their own file type (.rfa) and may be created in an environment called the Family Editor. After drawing the geometry for all required views, setting up the desired parameters for the new family, and specifying the default visibility of elements for different viewing directions, the family is saved with a new name in the library of families.

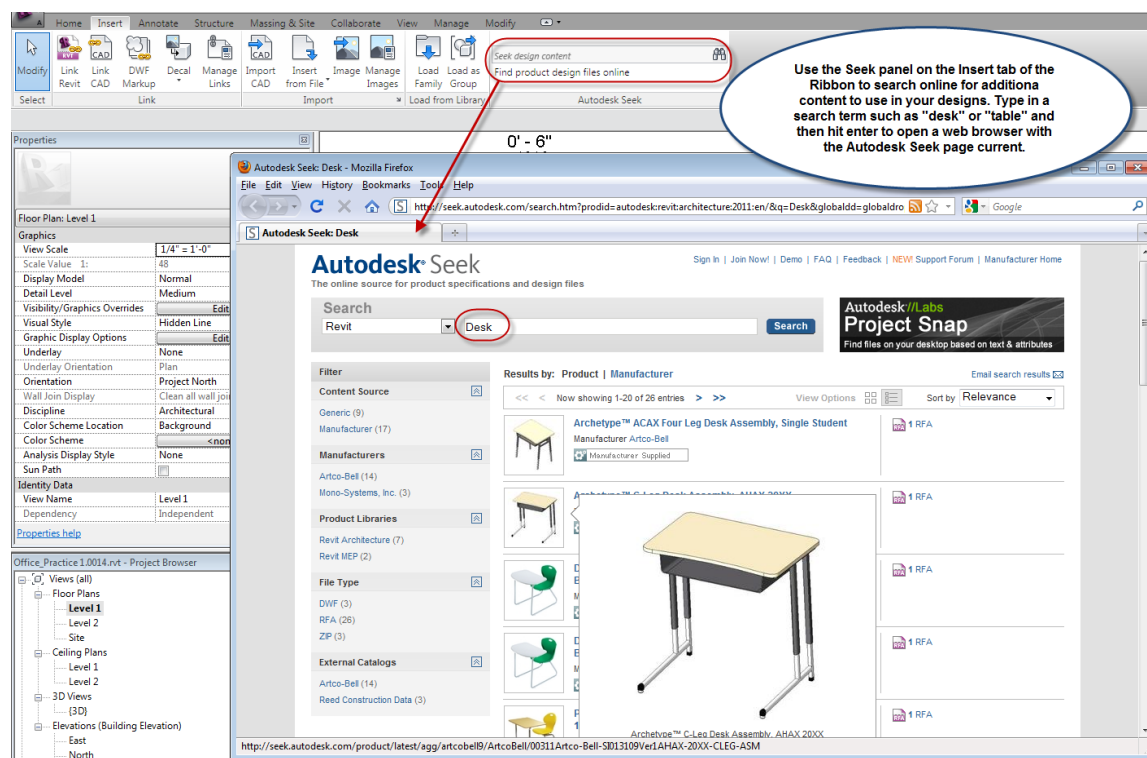
Revit Architecture provides hundreds of premade Families in over 30 different categories including Doors, Windows, Furniture, Plumbing Fixtures and many others.

These families may be loaded into a project

from the Insert tab of the Ribbon by choosing the Load from Library / Load Family selection. Multiple families may be added at a single time by pressing CTRL to add families to the selection set.



In addition to the library of Families on your computer, you can also access a wide range of families online. From the Insert tab on the Ribbon, use the Autodesk Seek panel to search for any type of Revit family content. This will open a web browser and link to the appropriate Revit content pages on the Autodesk Seek Website.

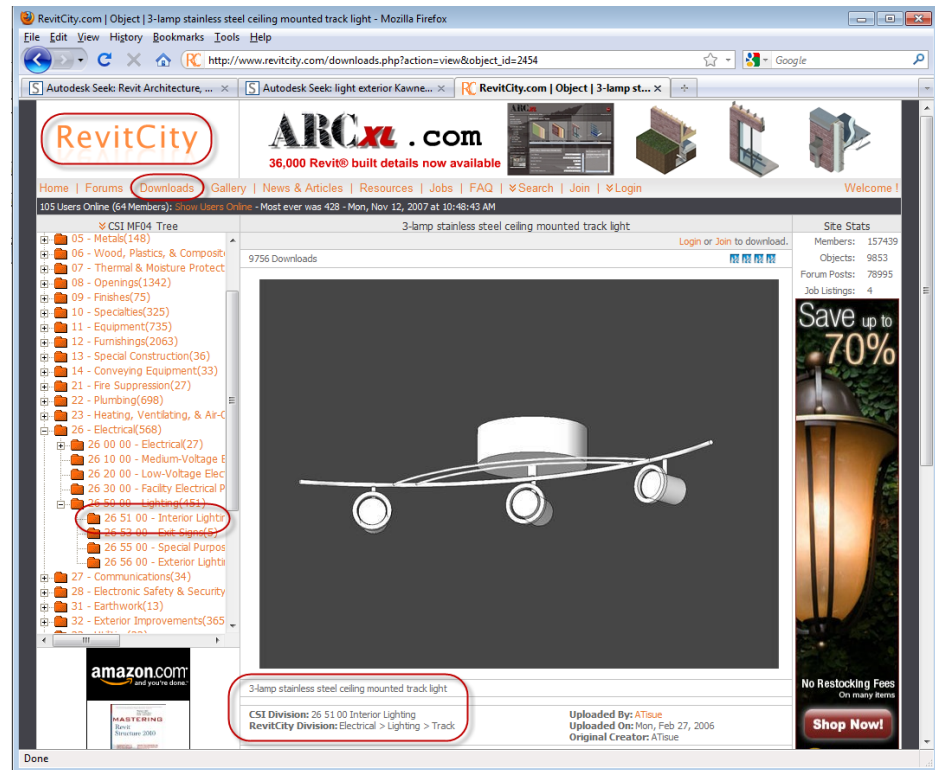


The Autodesk Seek webpage lets you perform additional searches using the Search field at the top and then filter the results with a number of different criteria such as content source and file type. View options allow you to obtain previews of the families and sometimes additional information about the family such as manufacturer or model number.

To download a family, pick the family name to open its download page. There may be several files available for different versions. Choose the desired versions and then pick the Download Selected button. This will download the family to a temporary folder, and open the file in the Family Editor. From within the Family Editor, you can choose the Load into Project tool on the Design bar or choose Saveas from the File menu to save it to a specific library folder.

More companies are creating Revit compatible content all the time. Some of these companies are listed in the Revit Manufacturer Library on the Web Content pages. More content can be found at the website, www.revitcity.com where literally thousands of families are organized into CSI categories and are available for free download after you register with the site and log in.

When you are placing elements such as doors, windows, components, annotation tags, etc. the Place Component tab on the Ribbon will display a Load Family button which may also be used to Load an existing family into the project. When you use this method, you can load a family and immediately place an instance of that family into your design.



The final method for loading a family into a project is to select an element or choose an element creation tool on the Ribbon, open the Type Properties dialog, and choose the Load button to the right of the Family name. When you load the family, it appears in the Type Properties dialog where you can set the Type, or create a new Type and then pick Ok to change the selected element or place an instance of the newly loaded family.

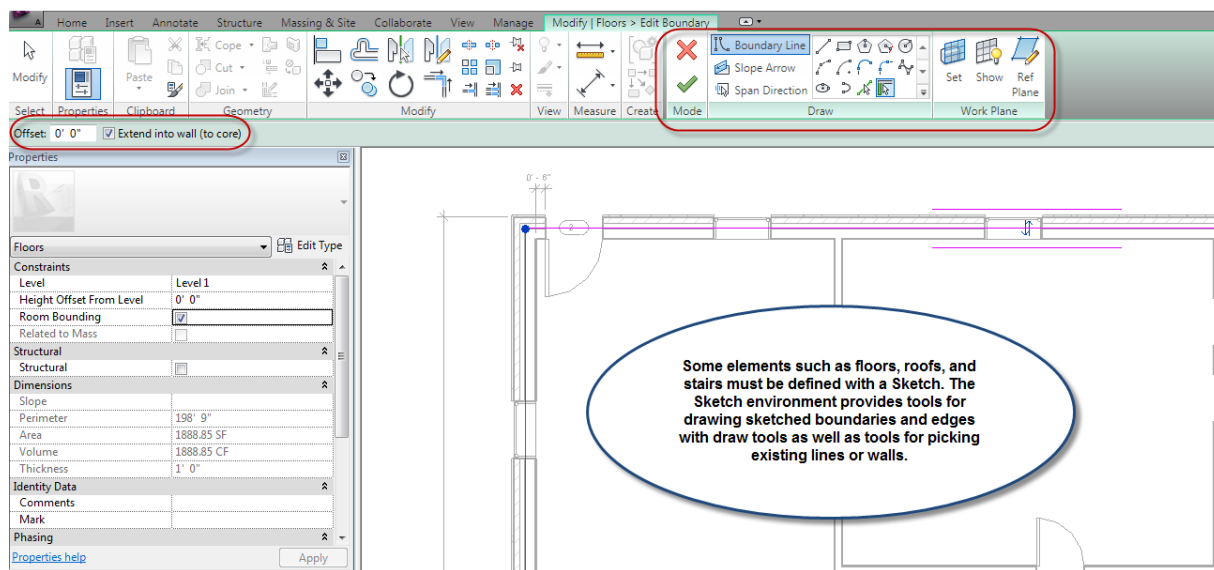
All families that have been loaded into a Project are listed in the Families category of the Project Browser. Below the family name, all types are listed. Right-clicking on the Family name in the Browser provides options to Delete or Rename the family, define a new Type for the Family, Edit the Family or Reload the family. Reloading a family optionally allows you to redefine all instances of that family which are already placed in the current project.

3. Introduction to Sketching and Sketched Features

Some elements in Revit can only be created by first sketching an outline of the object. Roofs, and Floors, require sketches. Other types of objects such as extrusions, openings, and regions also require sketches.

Sketch mode is a special environment in Revit which will open whenever you choose to create a sketch-based feature such as a floor or roof. Accessing one of these tools from the Ribbon will display a special tab called Modify | Create Boundary which displays all of the tools required to define that particular element type. For example the Create Boundary tab for a roof has tools for accessing a Slope Arrow and aligning eaves, while the Create Boundary tab for a stair will display tools for Boundary, Riser, Run and Railings type.

When you enter Sketch mode, all of the elements in the current view will appear grey and dimmed. The sketch itself will appear as pink entities which may be created by drawing them directly or by picking existing elements to trace.



Choose the Draw tools or the Pick tools on the Draw panel and specify settings such as offset, overhang, chain and radius. The offset/ overhang setting allows you to specify an overhang distance while sketching a perimeter which is very useful for both roof and floor elements.

The Pick Walls tool on the Draw panel allows you to pick a wall or set of walls and create an explicit relationship between the wall and the edge of the element being created. This means that if the wall moves, the floor, roof, stair edge, etc. will be dragged along with it, automatically updating and redrawing the linked element.

Sketches must form closed loops to create the most typical elements such as floors and roofs using the Footprint method. A loop is an end-connected series of segments with no openings, no overhangs, and no self-intersections. Use trim to create closed corners.

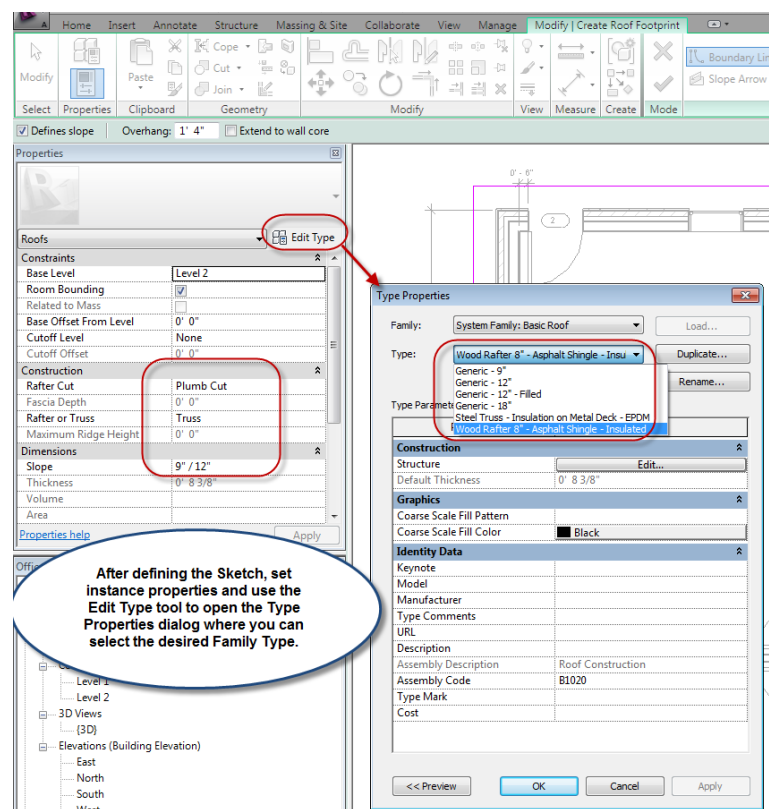
Loops inside larger loops allow you to create voids or openings, acting as internal boundaries for the sketched element. This lets you create openings in floors for stairs or openings in roofs for skylights.

Open sketches can be used to define custom stair boundaries which require two edges to define the stringers, and roof extrusions which only require a single edge.

After defining the required shape or edges for the sketched element, set the element properties such as floor type or roof type. Preset any instance parameters, pick OK, and then choose Finish Sketch to close the sketching environment and create the element.

If the element cannot be created, an error dialog will appear with a

description of the error. Choose the show button to highlight the problem area of the sketch in a different color. Choose Continue, resolve the sketch error and choose Finish Sketch again. (Repeat as required. ☺)



To modify a sketched element after it has been created, select the object and choose Edit Footprint on the Ribbon. You will then be able to edit the original sketch. Certain types of sketched elements cannot be edited in some view directions. For example a floor outline cannot be edited in an elevation view but will work in plan or 3D views. You may need to switch to a view that will support editing for the selected element type.

If you are in a perspective view and select a sketched element, the Edit button does not appear.

Sketching is not available in perspective views.

The Set tool on the work plane panel on the Sketch tab of the ribbon lets you specify the exact surface or face on which you wish to create the sketch. It is similar to the UCS command in AutoCAD. We will examine this concept in more depth when we cover modeling tools.

Sketches may include dimensions and constraints to help you define and control the shape of the sketched feature. Sketched lines and rectangles can be created with smoothly filleted corners by specifying a radius value on the Options Bar.

When you sketch a circle, you can create it with two clicks to define the centre point and the radius. After choosing the center location, you can also type the radius instead of picking a point. If you choose the Radius checkbox on the Options bar, you can preset the radius value and then add multiple circles with a single pick each to define their centres.

The Polygon is similar in operation to the Circle but also includes settings for the number of sides as well as Inscribed or Circumscribed options.

The Arc options include 3 point arcs, Centre /Start / End arcs, Tangential arcs, and Fillet Arcs which allow you to create fillets and rounds between almost any two edges. Fillet arcs automatically trim the original elements as you define the arc.

Ellipses and elliptical arcs may be defined with a minor and major radius.

Splines may be created where required to create complex curves. If it is possible to define a shape with lines and arcs instead of splines, it is recommended to do so as Splines require more processing time.

Exercise Notes

In the following exercise you will practice modifying element type and instance parameters, define new types for existing families, and load new families into your project. You will also be introduced to Sketch based features and working within the sketch environment.

1. Open the project you have been developing in the previous classes. Set Level 1 active and Zoom to Fit. At this point all of the walls should be dimensioned and all exterior openings should be dimensioned and constrained. The interior doors should be set to maintain a 4" offset from the adjacent walls.
2. Zoom in to the large Office in the upper left corner of the Plan. Move your cursor around the room and when the large X highlights indicating the Room object, pick it to select the room. In the Element Properties palette it indicates in the Selection control that the element is a Room. Check the pulldowns for Family and Type and you can see they are not available. You cannot load a different family, select a different type, or access the edit function for this type of element.
3. In the Instance Parameters section at the bottom, Review the available settings in the four groups of Parameters: Constraints, Dimensions, Identity Data, and Phasing. The dimensions section displays the exact area and perimeter but the values are grayed out as they are being calculated from the actual room size. In the Identity Data section there are numerous fields for parameters that could be linked to a Room Finish schedule. In the Name field, change Office to Meeting Room and pick Apply.
4. The Room tag associated with the Room has automatically updated with the new Element Property for the Name instance parameter. This can be set from the Tag or from the object being tagged. Pick the room tag and then pick on the name field to highlight it. Change the name to Storage Room and pick a point in the room.
5. Select the Room object again and view the Element Properties. Confirm the Identity Data, Name parameter has changed to Storage Room. Pick OK to close the dialog. Hit CTRL-Z to change the room name back to Meeting Room.

6. Switch to the Default 3D view and Zoom in around the front door area where you can see 2 or 3 of the smaller windows. Pick one of the windows, and in the Element Properties Instance Parameters section change the Sill Height to 42 inches. Pick Apply. The selected window has moved up in the wall but the other windows of the same type have not been modified since the parameter we changed was an Instance Parameter and not a Type Parameter.
7. It is possible to change instance parameters on multiple objects at one time. Pick the same window you just modified, right-click and choose Select All Instances. Look at the selection control window in the properties palette. It should show a 4 beside the Windows icon to indicate you have 4 objects in the current selection set. In the Element Properties palette, the Sill Height parameter is blank indicating that the value varies with the different elements. Set the Sill Height to 30" and pick OK. All four windows move down.
8. Zoom to fit and drag a large selection window around the entire building. Pick the Filter tool on the Selection panel of the Ribbon and choose Check None. Put a check mark beside Windows and pick Ok to close the dialog. In the Properties Palette, note the "multiple types selected" in the Type pulldown. Even though you have two types selected, both types have a sill height parameter. Set this value to 42" and pick Apply. All windows move to the new sill height.
9. Zoom in around the front door and you'll notice that the window head is now higher in the wall than the door head. Ideally they should align with each other but we don't want to cut through the sill stone between the brick and the block portions of the wall. We could edit the Wall Type and move the division between the materials lower in the wall, but we're going to work with wall types more in another class. Let's modify the Window's Type Parameter for its height and rename it appropriately.
10. Pick one of the 24" wide windows, and in the Element Properties palette, choose Edit Type. If you look in the Type Properties dialog, under Dimensions, you can see a field for Height. In the Type Properties dialog, set the Height to 42". Pick the Rename button and change the Type name to 24" x 42". Pick Ok twice to close the dialog boxes.

11. All of the 24 inch windows resize to the new parameters. Pick one of the windows and view its name in the Type Selector. Pick the Type Selector pulldown to view the available types and you'll see that the original 24" x 48" window is no longer available. Let's try it again with the 36 inch windows but retain the original type.
12. Zoom or pan until you can see a 36" window, select it and view its element properties. Pick the Edit Type button to open the Type Properties dialog and pick the Duplicate button. Set the name for the new type to 36" x 42" and pick OK. Change the Height to 42" and pick OK twice to close the dialog boxes. The selected window resized and is now displaying the new type in the Type Selector window. Zoom back a bit until you can see another of the 36" wide windows and you'll see it was not modified and is still set to the 36" x 48" type.
13. Pick one of the 36" x 48" windows, and type SA to select all instances. In the type selector, pick the new 36"x 42" to assign it to the selected windows.
14. Switch to the Level 1 plan view and zoom in to an area where you can see two instances of both types of windows. You can see that the sill element is running directly below the actual window sash which is situated almost flush with the exterior wall. We want to inset the windows about 3" from the exterior brick face. Pick one of the windows and view its element properties. Pick Edit Type and change the Window Inset value to 3.5". Pick OK to apply the changes to all windows of the selected Type. Repeat for the other size of window.
15. Zoom in to the Washroom area. From the Insert tab on the Ribbon, choose Load from Library/ Load Family. In the Load Family dialog, browse to the Imperial Library if it does not open to that folder automatically and then scroll down and double click the Plumbing /Architectural / Fixtures Water closets folder. Pick the Toilet-Domestic-3D.rfa family and pick Open to load it into the current project.
16. On the Architecture tab of the Ribbon, choose Component and pick the new toilet family component in the Type Selector. If you receive a prompt about a plumbing tag family not being available, just pick Ok to continue or if you would like, browse to the annotation tags category and load a fixture tag.

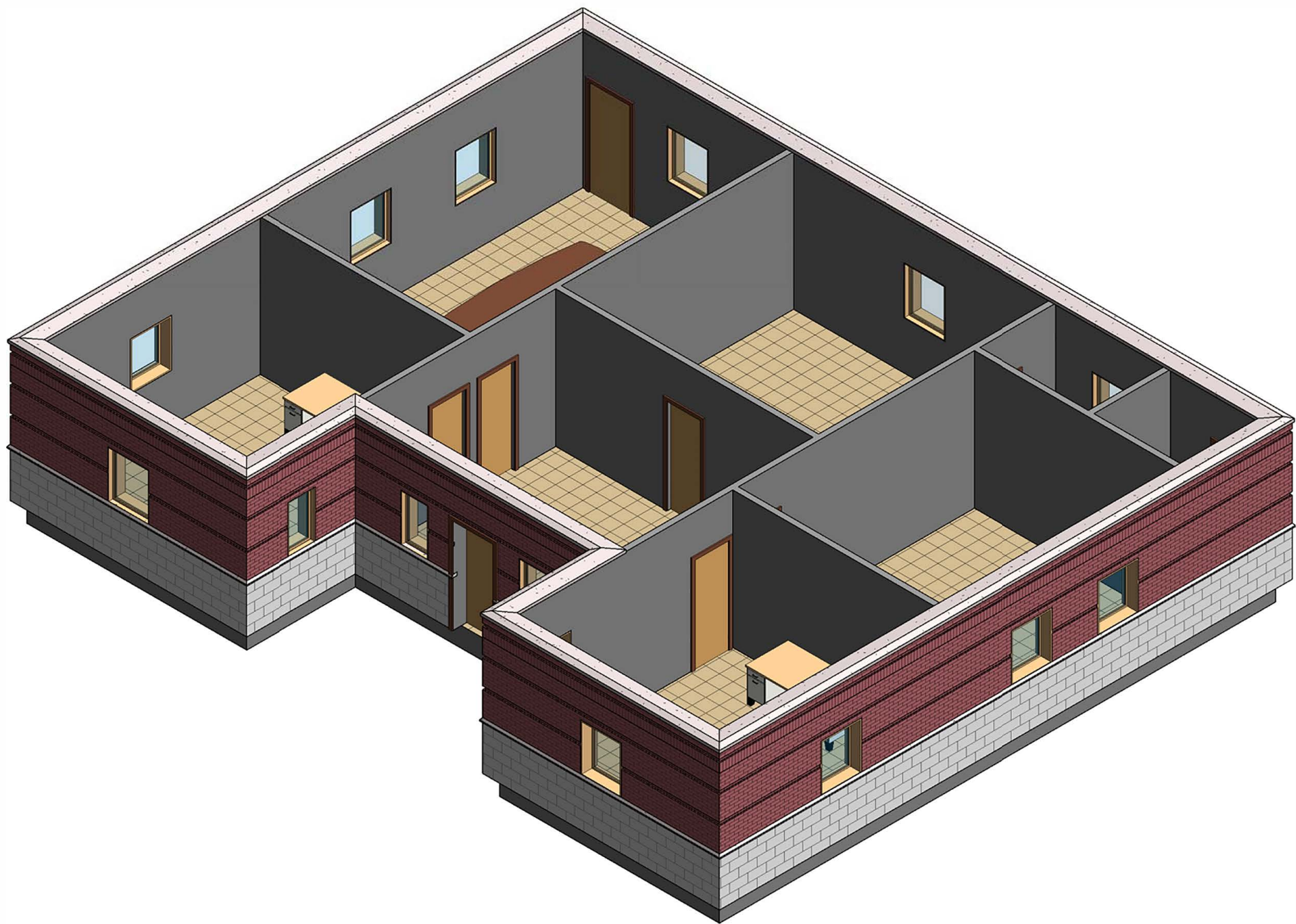
17. Press the space bar until the toilet is in the correct orientation and then pick a point to place an instance in the Washroom. Pick the toilet and adjust its temporary dimensions so the toilet is positioned 2" from the wall against which it is placed and 18" from the closest adjacent wall.
18. Pick Component and then pick Load Family. In the Load Family dialog, choose Casework and then Base Cabinets. Choose the Vanity Cabinet – Double Door Sink Unit and pick Open. In the type selector choose the 27" model. Pick a point in the upper left corner of the Washroom to place an instance of the vanity. Hit ESC twice to finish the component place command.
19. Switch to the default 3D view and modify the view angle until you can see down into the washroom and view the vanity. Hmm. No counter top and no sink, yet. This makes sense actually as it is the same way it can be built and allows you to tag and specify the cabinet, the counter, and the sink separately. Switch to Level 1 and zoom in to the washroom.
20. Choose the Load Family tool from the Insert tab, browse to the Casework / Countertops folder and choose the Vanity Counter Top w Round Sink hole. Place an instance of the counter top in the same corner as the Vanity.
21. Select the vanity countertop and try dragging the shape handles to change the length of the cabinet. Right-click and choose Element properties and then set the Length to 28" and the Sink Location to 14". Pick OK to close the dialog and apply the changes. Switch to the 3D view and you can see that the counter was placed at the correct height. If you check the Element properties for the counter, you can find the Height preset in the Type Parameters.
22. Switch back to the plan view to add a sink. Load the Sink-vanity Round family from the Plumbing Fixtures folder in the Imperial Library. Zoom in to the vanity and place the sink so it is centered over the hole in the vanity counter. Select the sink and review its element properties. Note the countertop height value in the Type Parameters. Switch back to the 3D view to confirm the correct placement of the sink.
23. Switch to the Level 1 view and zoom in around the Meeting Room in the upper left corner. If there is a desk in this office, delete it as we will be adding a conference table in this room instead.
24. Access the component tool and check the type selector for a large table. Nothing. Choose Load and browse the Furniture and Furniture Systems folders. There are domestic tables such as dining tables here but no large meeting room tables. Pick cancel.

25. It would certainly be possible to load a dining room table and then create a new type with the oversize dimensions required for our meeting room table. We could even rename the family by finding it in the Project Browser, right-clicking over the family name and using the Rename option to change Dining room to Meeting room. This would be a good practice exercise and you can try this on your own.
26. From the insert tab on the ribbon, in the Autodesk Seek panel, enter "table" and hit enter to open a browser and go to the Revit online library. Browse through the available families and towards the bottom of the list you'll see a few examples of tables which might work. In the search field Conference Table and hit enter. Under Manufacturers, choose Bernhardt. Browse the available tables and select the model called Odeon. Select the latest version and pick Download Selected. Pick the file and choose Open. (if prompted to Upgrade the file to the current version of Revit, choose Yes.)
27. A new window will appear displaying a 3D view of the table and chairs. Look at the title bar at the top and you'll notice that the file name is shown with an .rfa extension. Look at the Ribbon and you will see a new panel called Forms. This is your first look at the Family Editor environment where families are created and modified. Switch to the Ref. Level view in the Floor Plans section of the Project Browser.
28. Type VG to open the Visibility Graphic Overrides dialog. Switch to the Annotation tab and choose Show Annotation categories in this view. Pick OK. In the plan view of the table you can see a number of dimensions and a series of dashed green lines called Reference Planes which define critical locations for the elements in the Family. Try picking one of the reference planes and you will see a number of lock icons appear indicating its current constraints.
29. Pick the dimension at the top that says Table Length = 10'-0". On the Options bar, in the Label pulldown you can see the Name Table Length and beside it an empty checkbox for Instance Parameter. Dimensions with labels are one of the main means of creating the parameters that we see in the Element Properties dialog.
30. On the Properties panel of the Ribbon Home tab, choose Family Types. In the Family Types dialog, Under Family Types, Pick New. Call the new type, 96" x 48" and then pick Apply. Create a second new type called 120" x 48". Set the Table Length parameter to 10'-0". Pick Apply and then OK.

31. On the Ribbon, choose Load into Project. Choose the Current project you have been developing and pick Ok. Place an instance in the Meeting Room. Try switching the type for the table to some of the different sizes and choose the 48" x 120" to create a 10 foot table.
32. In the Level 1 view, Zoom to Fit. From the Build panel on the Ribbon, choose Floor. The existing elements will fade and the Sketch environment becomes active. On the Options Bar pick the checkmark beside Extend into wall (to core) and leave the offset at 0". Choose the Pick Walls tool and start picking the exterior walls one at a time. Note how the sketch lines are automatically trimmed or extended to clean up at the corners. Continue picking the exterior walls until you have created a closed loop. (you can also Tab select to pick up the entire chain of walls at one time)
33. In the Properties palette type selector, set the type to Wood Joist 10"-Ceramic Tile and pick OK. In the properties palette, under constraints confirm that the Level is set to Level 1 and the Height Offset from Level is set to 0". The floor thickness will be defined downward from the level and offset location. On the Ribbon, choose the green checkmark to finish the sketch and complete the floor.
34. Switch to a 3D view and type SD to shade the view. Hmm. No tile pattern. Pick the floor object and in the Type Selector try switching to the floor type with a wood finish. After choosing a new type, pick in an empty area to clear the selection so you can see the floor finish. The wood finish appears as a strip flooring pattern. Change the floor type to Steel Bar Joist 14" – VCT on Concrete and pick outside the building to view the result. The initial floor type we selected does not have a surface pattern defined for the material which is why the tiles did not appear. This can easily be modified but we'll wait for another class to try it. 😊
35. Switch back to the Level 1 view. Type SD to shade the view. Note how the desks and plumbing fixtures are hiding the tile floor. The desks and fixtures are defined with something called masking regions which will conceal objects below. Zoom in on one of the doors and you can see that the tiles are showing through the door panels instead of being hidden as you might expect.
36. Pick the door and on the model panel of the Ribbon choose Edit Family. When prompted to open Single-Flush for editing Pick Ok and the door family will be opened in the Family Editor. Switch to the Ground Floor view under Floor plans.

37. On the Annotate tab of the Ribbon, choose Masking Region and the Sketch environment will become active. From the Draw panel, choose Rectangle. Pick two corners on the door panel to trace the panel with a rectangle. Select all four lock icons to lock the sketch to the door panel edges. Pick Finish sketch and then choose the Load into Project tool. Select the main project file, pick Ok and then choose Yes in the Reload Family dialog to confirm that you will be overwriting the existing version of the door family with the newly revised one. Shade or Hide the view to see how the doors now conceal the tiles. We could easily do the same thing with table and chairs although the chair shape would require more effort.
38. Save and close your project. Backup your files as usual. We will continue in the next class with a discussion of levels and elevations and begin to layout some views on Sheets.





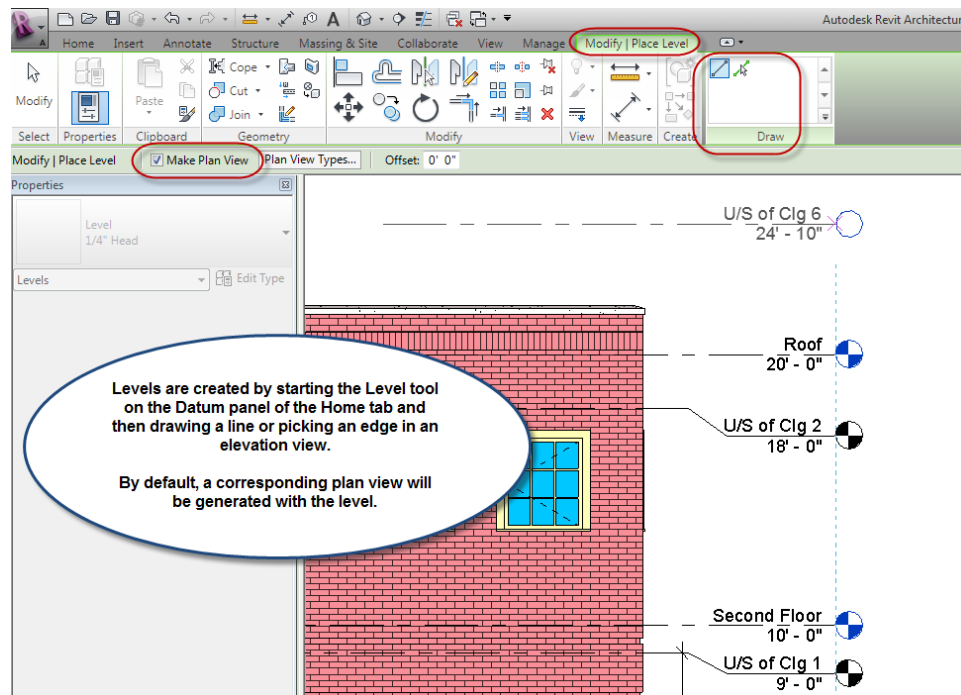
AGENDA:

1. Creating and Working with Levels
2. Creating 3D Perspectives with Camera Views
3. Introduction to Sheet Creation and Drawing Views

1. Creating and Working with Levels

Levels are used to define the vertical locations within a building which are critical to locating features within the design. Examples include floor levels, grade levels, footing levels, foundation wall tops, etc.

Levels are defined by drawing points or picking an edge along a horizontal axis in an elevation or section view. When you draw a level line, by default, Revit will automatically create associated floor plan and ceiling plan views.



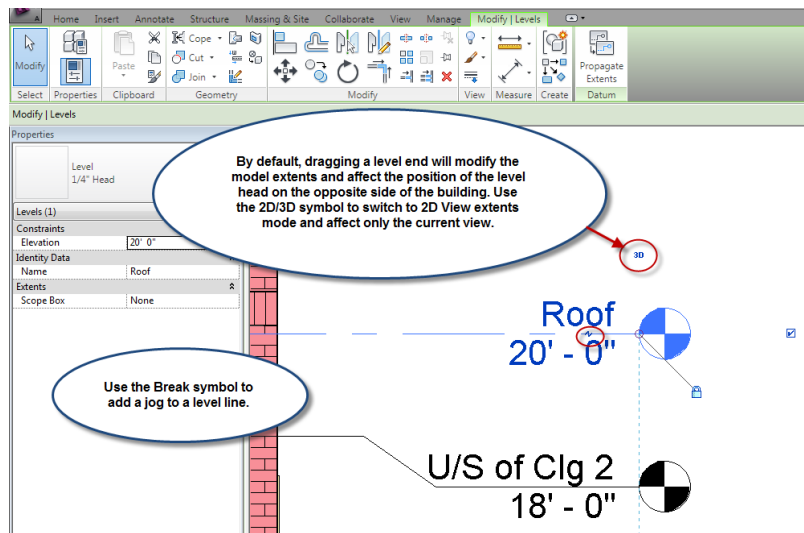
Levels act as reference planes for Level hosted elements such as Roofs, Floors, and Ceilings. The location of these elements may be set with an offset distance from any existing level.

Walls also relate to levels and may have their top or bottom locations constrained to certain levels.

Offset distances may also be used in a Wall's element properties to further fine-tune the position of the subcategories of objects in that wall relative to levels.

New levels may be added at any time, before or after you have started adding building elements to the design. If you start a project with the default template, Revit includes two levels, Level 1 and Level 2. You may rename these levels or create your own.

To create a new level, open an elevation or section view. The Level tool is found on the Datum panel of the Architecture tab on the Ribbon or use the shortcut LL. It will default to the draw option, but you can use the Pick option to select existing edges on your model. Pick two points with the second point where you want the label and head to appear. As you drag the head towards existing level heads, smart alignment lines appear and if you pick a point, the level heads will be locked in alignment so they can be repositioned by dragging any one of the levels.



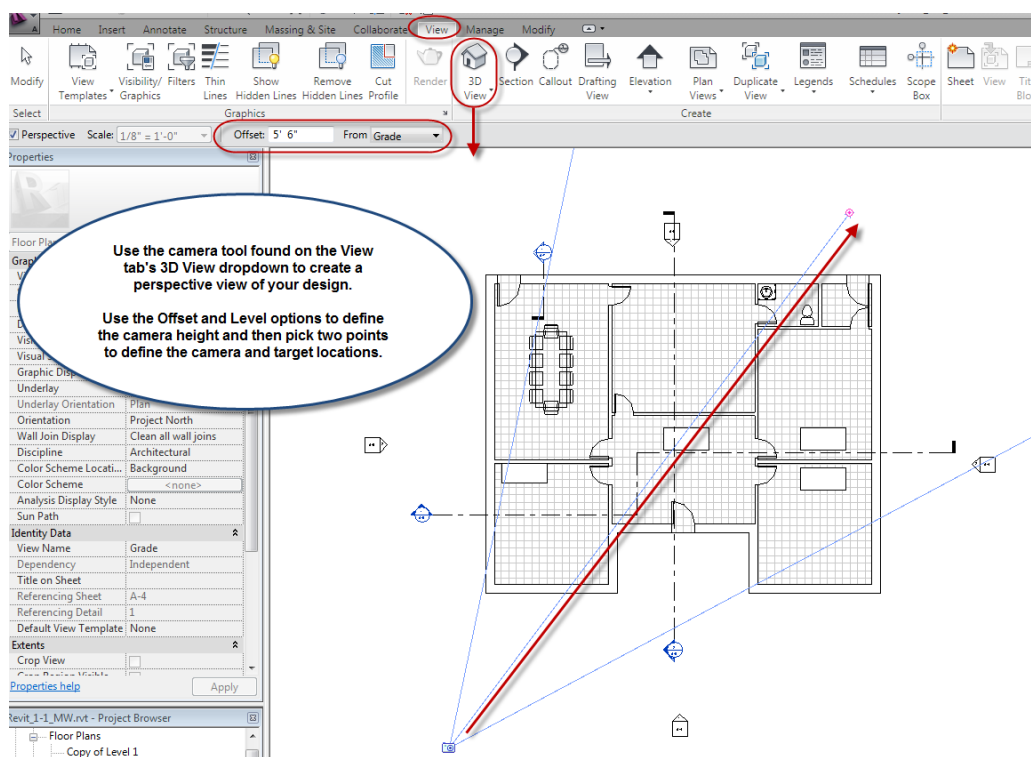
After you draw the level, you can pick on the text to highlight it and rename the level. If you have a couple of levels that are quite close together, pick the level line and a small level symbol will appear near the head. Pick this symbol to add an elbow to the level as shown in the example at right. After adding the elbow drag the blue control grips away from the label so the text reads clearly.

The different colored level heads indicate whether or not a level has an associated plan view. Blue indicates a linked view. If you double-click a blue level head, it will switch to the associated plan view. Copying a level line always creates a level without linked views. To change a level's height, you can move the level line by dragging it up or down, you can pick the level height parameter and type in a new value or you can add dimensions.

2. Creating 3D Perspectives with Camera Views

3D Views may be created with either Parallel or Perspective Projection. When you create a 3D view by selecting the Default 3D View tool on the Standard toolbar, the resulting view is in parallel projection where the heights of elements in the model will appear constant at any position along the building.

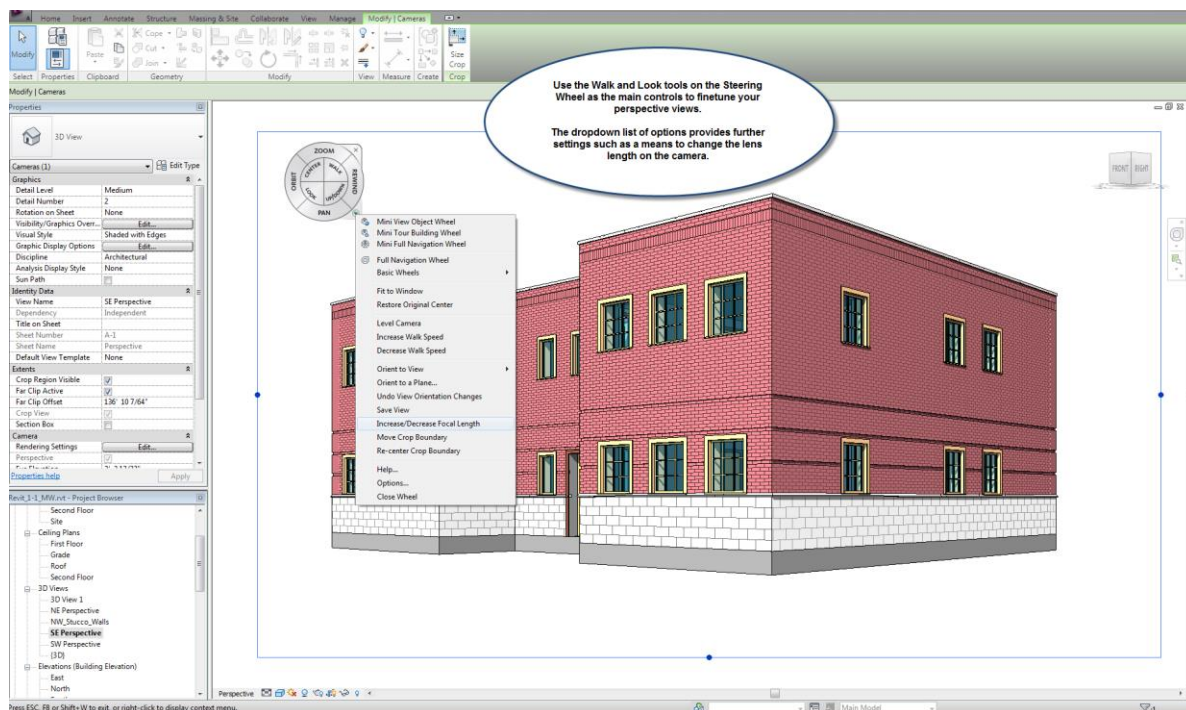
In a true Perspective, objects will appear to recede in width or height as they get further away from the viewer's position. To create a perspective view with Revit, you must use the Camera tool to create the view. The two different projection types cannot be switched in an existing view as you can do with some other modeling programs.



The Camera tool, found on the View tab of the Ribbon, is available in Plan, Elevation and Section views but is most typically used in the Plans. When you select the Camera tool, a camera icon will appear at your cursor and you can pick first one point where you want to position the camera and then a second point to define the target for the view. The options bar allows you to specify the exact camera height relative to any level.

When you add a camera to create a new 3D view, Revit will immediately switch to that view. Revit names the view with the default naming convention of 3D View 1, 3D View 2, etc. but the views can be renamed by right-clicking the view name in the Project Browser and selecting the Rename option.

By default, camera views are displayed with their crop region visible. If you select the crop frame, it will display 4 control grips at the midpoints of each side. If you drag a grip to resize the crop region you can adjust the Field of View. If you initially placed your camera too close to the building and you resize the crop regions to expand the view, you will lower the camera lens length and start to distort the view.

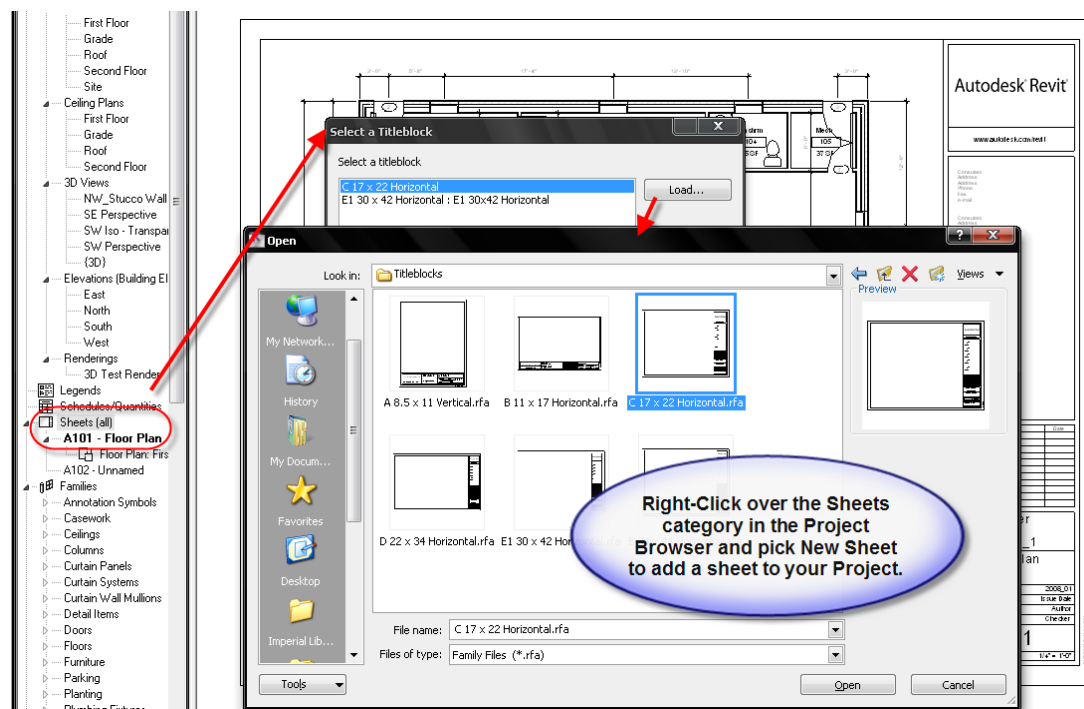


To adjust the view after creating a camera, open the Full Navigation steering wheel. If you want to ensure your camera height does not change, use the Walk and Look options. The look tool rotates the view target around the camera position as if you are standing in one spot and pointing the camera at different locations. It can modify the target height. The walk tool simulates you walking around with your camera while keeping it pointed at the same target location. This is a good option for moving in or out from the view. To make lateral changes to the view, use the Orbit option, but as you do, keep an eye on the camera and target elevation values in the properties palette. Try to always keep the “eye elevation” at a realistic eye level and the target elevation just slightly higher than the eye elevation.

3. Introduction to Sheet Creation and Drawing Views

A Construction Document set contains all of the information required to supply clients, consultants, and building contractors with the necessary dimensions and notes to create your building design. A typical set of construction documents will contain a minimum of plan drawings, elevation drawings, and building section drawings. Larger or more complex projects may also include detail drawings, structural drawings, schedules for doors, windows, and room finishes, and even rendered perspectives.

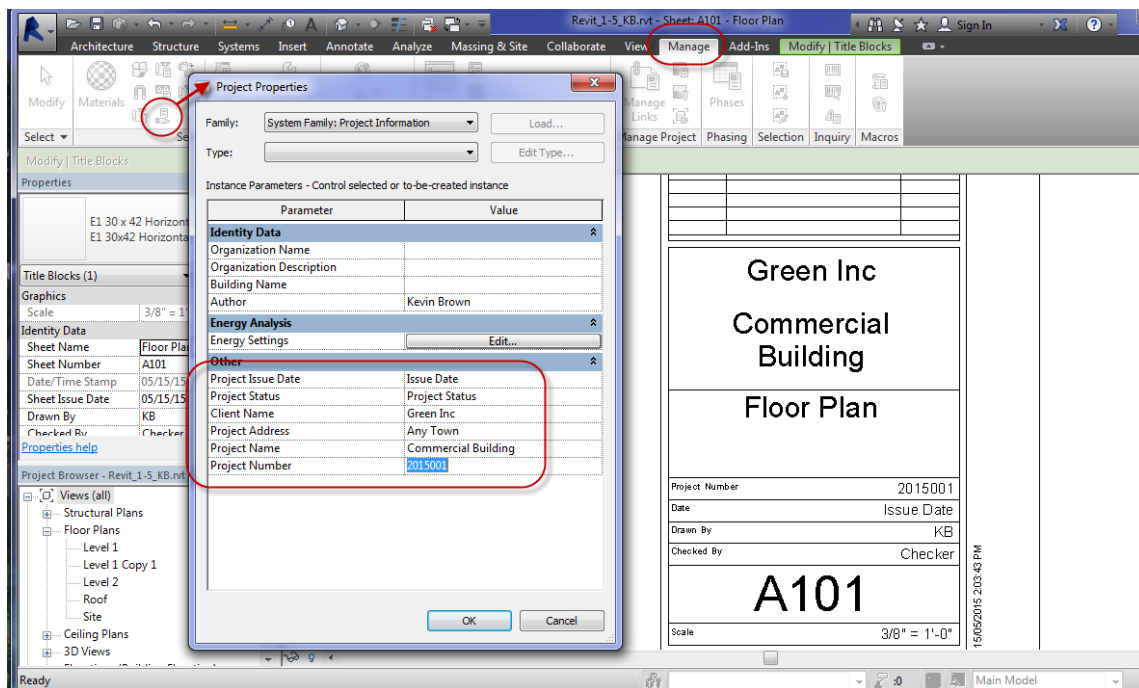
To create a set of drawings to document your design, you create Sheets and then add various drawing views and schedule views to those sheets. A set of Sheets can be printed to hard copies or published to an electronic format such as DWF or PDF files.



To add a sheet to your Project and start laying out views, right-click over the Sheets category in the Project Browser and choose New Sheet. Select a title block and sheet size from the list or pick Load to browse to the Title blocks folder in the Library of families. Select the sheet, Pick open and Ok to load it into the project and make the new sheet the current view.

The title block on a sheet displays information about the project including Project Name and Project Number as well as information about the individual sheet such as the drawing names, sheet number and author. Project Properties may be found on the Manage tab of the Ribbon.

The information which populates a title block is a combination of text objects and fields of text which are linked to Project Properties. The information in these fields may be generated automatically by the Project settings, or may be edited directly on the Sheets.

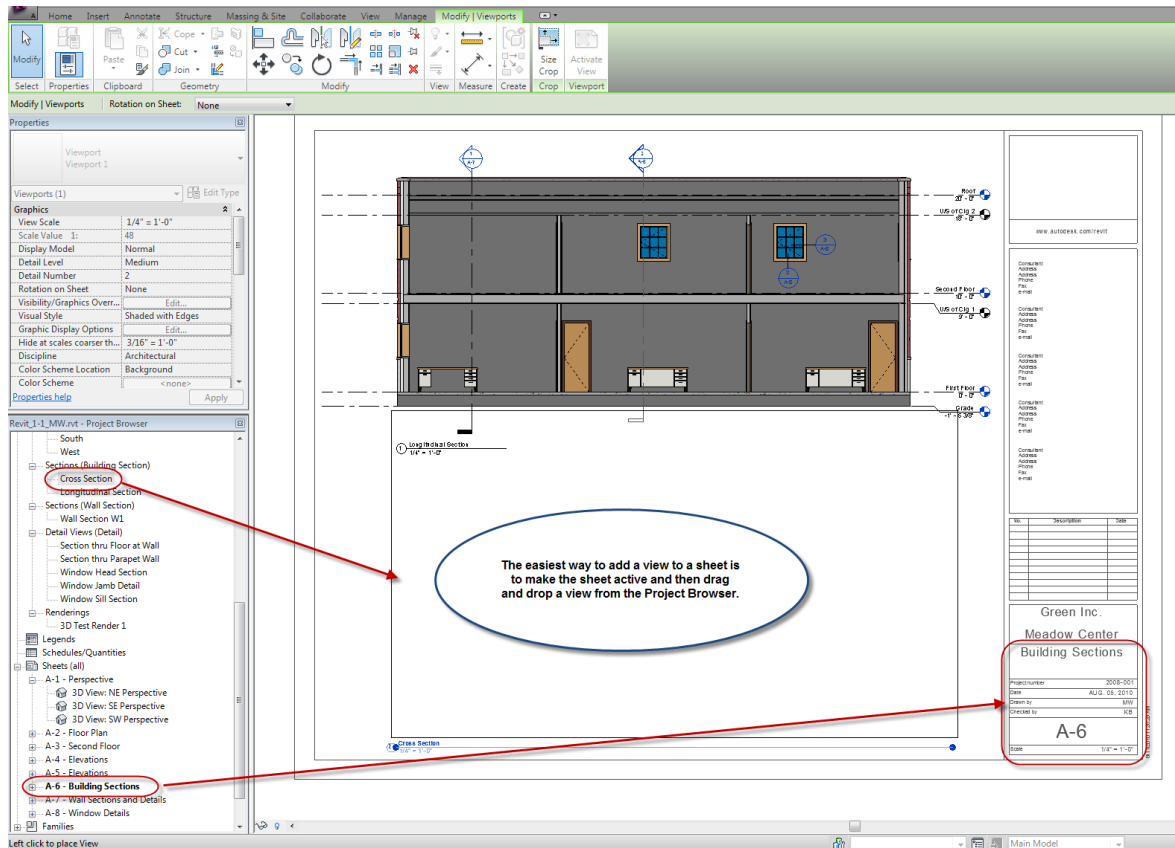


To edit the fields in a title block directly on the sheet, pick the title block to select it and any editable fields will be shown in blue text. Pick the blue text and you can replace the placeholder text with your own values.

Sheet specific information can be set in the View Properties palette for any sheet and will include things like Sheet Name, Sheet Number, Checked By, etc.

The Scale field is generated automatically from the view scales for any views on the sheet. If all views on the sheet have the same scale it will be shown in the title block. If the scales for views on the sheet vary, the title block will display "As Indicated".

One or more views may be added to a sheet. Including plans, elevations, 3D views, sections, details, and even rendered views. A single view may only be placed on a single sheet although it is possible to create duplicate views which may be placed on additional sheets.

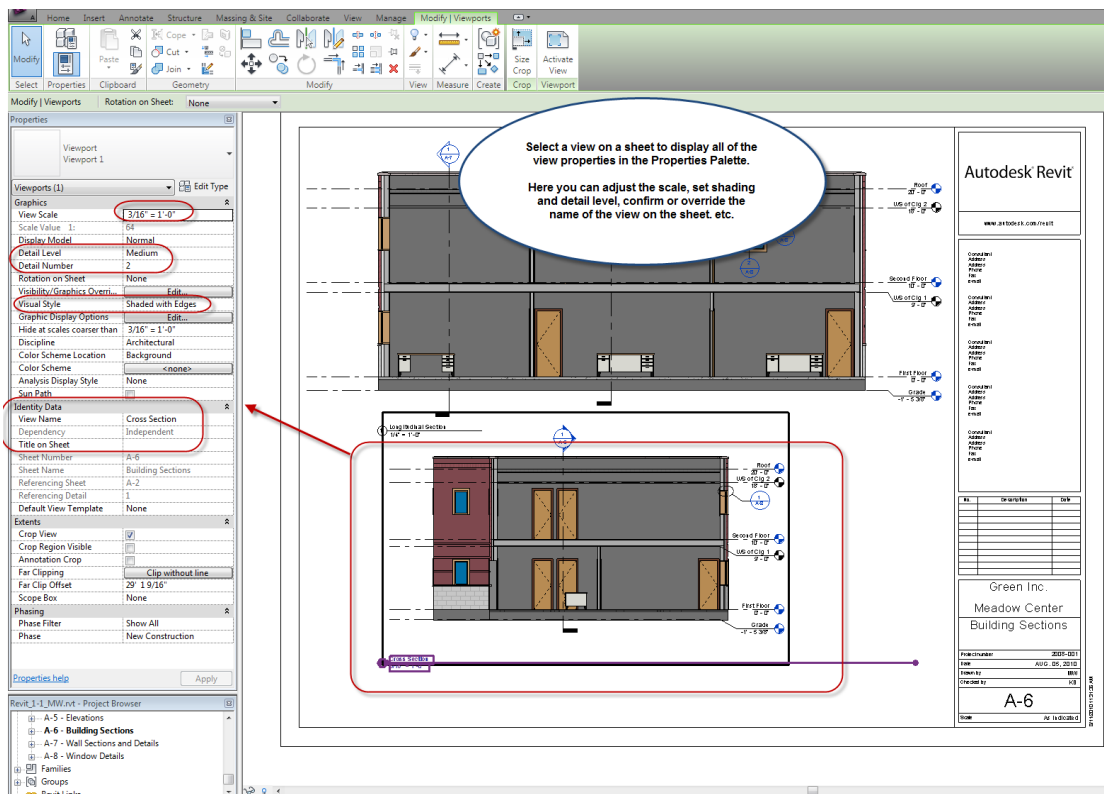


The simplest method for adding a view to a sheet is to drag and drop the view from the Project Browser on to the active sheet. A red outline shows the extents of the view and its size on the sheet. When you pick a point to define the view location on the sheet, the view appears, still selected, with a red outline and a view title below the view.

Views may also be added by choosing the Place View tool on the View Tab of the Ribbon. The Place View method will display a Views dialog with a list of all views which are available to add. Only views which have not yet been added to a sheet will be displayed. Choose the view you wish to add and then pick the Add View to Sheet button. To reposition a view on a sheet, pick anywhere within the extents of the view and drag it to the desired location.

The size of the view relative to the sheet will be dependent on the View's scale setting. To modify the scale of a view, you can switch to that view, change the scale on the View's control bar or access the View Properties control and set a new scale.

To modify the scale of a view on a sheet, in the context of the sheet, select the view in the sheet and then select a new scale in the Properties Palette. This also provides access to all other settings for the selected view such as detail level, view name to be displayed on sheet, etc.



When you add a view to a sheet, it will automatically add a View title indicating the View name, the view scale, and the number of the view on the sheet. By default the view title on the sheet will be the same as the original view name. If you edit the view title and modify the name, it will also rename the original view.

If you want the view to display a different name on the sheet, access the View's properties and in the Identity section, enter a new name in the Title on Sheet field. If you delete this value, the view title will revert to displaying the original view name.

To move the View title, pick it and drag it as required. *To change the length of the title line below the view, pick the view itself to display a control grip on the title extension line which may be dragged to a new length.*

When you add more than one view to a sheet, you can align the view titles with smart alignment guides. Add the required views, and fine-tune the position of the View titles if required. Pick and drag one view into alignment with the others and a dashed line will appear when they are perfectly in line. This alignment with the view titles will even be maintained if the view scales are modified.

To lock a view's position on the sheet, you can use the Pin tool. When you pin a view, you can no longer move it or access the view title controls to change the name, number, or extension line length directly on the sheet. Control grips are hidden and all text fields display in red. A pinned view can still be modified via the Properties palette

When views are placed on a sheet, you cannot select or modify any of the building elements and only the view and view title can be selected. It is possible to edit the building elements within the context of a sheet by Activating the View. If you right-click over a view on a sheet and choose Activate View, the sheet elements, any other views on the sheet, and the title block will be displayed in a halftone (gray) appearance.

When a view is activated on a sheet, you can add dimensions, create notes, pan the view, and change the view scale or other settings on the View control bar. It is even possible to edit the building elements directly to accomplish minor edits. For extensive editing of the building model, it is best to open the original view. When you have finished making changes to an Activated View on a sheet, right click and choose Deactivate view to switch back to the default sheet view.

Double click inside a sheet view's extents to Activate the view. Double-click outside the sheet view's extents to Deactivate the view and return to the Sheet environment.

To Rename a sheet, right-click on the Sheet Name in the Project Browser and choose Rename. A Sheet title dialog will appear with fields for both the Number and the Name. This allows you to rename and renumber sheets without making the sheets active and editing the fields directly in the title block.

Exercise Notes

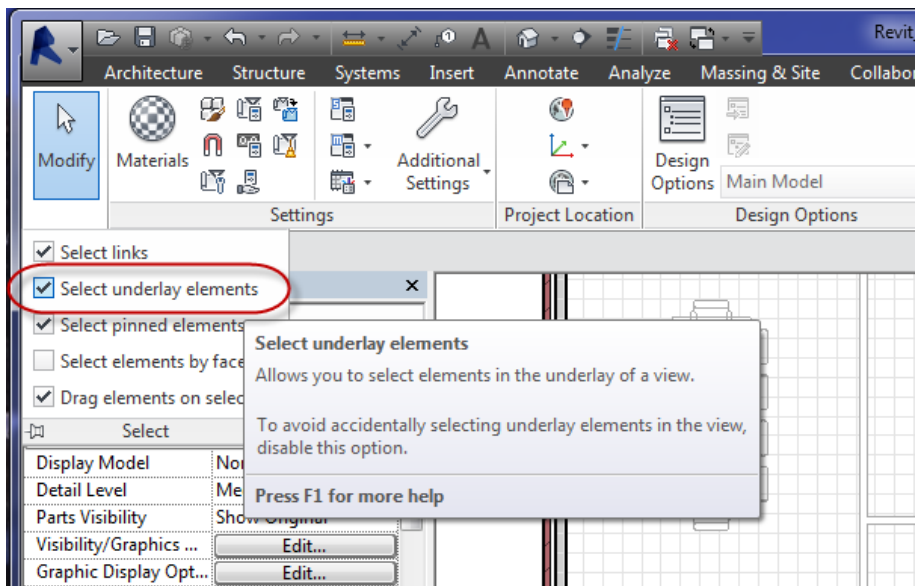
In the following exercise you will create new levels and constrain building elements to levels. You will also create Perspective views of your model by adding Cameras to plan views. Finally, you will learn how to create Sheets for a construction documents set, and begin placing and editing views on sheets.

1. Open the Revit project you have been developing over the last few classes. In the Project Browser, under Elevations, double-click South to switch to the South Elevation.
2. There are still only the two default levels in this project and they were originally defined with a much larger extents than we require for our design. Pick the Level 1 level line to display circular control grips at both ends that are used to set the length of the level line. Select the control grip at the end without the level name and drag it towards the building. The level lines will be locked and move together if you keep the control grips aligned.
3. Type ZF. Pick the Level 2 line and then drag its control grip towards the building. Leave enough room beside the elevation labels to accommodate the dimensions you will likely be adding in this area. To reverse the side of the building that the labels are displayed on, use the checkboxes beside the ends of the level lines. Try to ensure that there is an equal length of level line on both sides of the building.
4. Type ZF. Switch to the North elevation. Adjust the length of the level lines as required.
 - a. *If you wish to adjust the position of a level line on only one side of the building and not affect the corresponding position on the opposite side of the building, pick the level line and make sure that the 2D/3D toggle is set to 2D.*
5. Adjust the length of the level lines in the East and West views. In all 4 elevations, set the view scale to $\frac{1}{4}'' = 1'-0''$ and Zoom to Fit. Set the model graphics style to hidden line. Set the South elevation current.
6. Zoom in on the Level 1 Label. Float your cursor over the blue level head and double click to switch to the Level 1 floor plan. In the project browser double-click South to return to the previous view.
7. Pick the level line and then move your cursor over the blue Level 1 text and pick it. Rename the level to First Floor and pick outside the text box to apply the change. Choose Yes to confirm renaming the corresponding views. Look in the project browser at the renamed First Floor level.

8. In the Project Browser, right-click on Level 2 and choose Rename. Set the name to Second Floor and once again choose Yes to confirm you want to rename the views and levels. In the drawing area zoom out until you can see both level lines and then pan down a bit.
9. From the Datum panel on the Architecture tab of the Ribbon, choose Level and move your cursor just above the building in the left side of the view. A dimension will appear showing you the distance from the adjacent level. Pick a point and drag your mouse to the right until a dashed alignment line appears indicating it is in line with the levels below. Pick a point and then pick the blue text on the temporary dimension between the two levels and set it to 10 feet.
10. Pick the Level 3 text and rename the level to Roof. Confirm you want to rename the corresponding views. Check the Floor Plans category in the Project Browser to view the new levels. If you still have a Copy of Level-1 view from an earlier practice, right-click over the view name and choose Delete.
11. In the elevation view, pick the Second Floor Level and on the Modify panel choose Copy. Pick a base point for the copy anywhere around the level line, drag your mouse down and type 1 to create new level at an elevation of 9'-0". Note the color of this new level's head. Copied levels never automatically create linked views as would be indicated by a blue level head.
12. Zoom in around the two levels with the overlapping text labels and pick the Level 4 line. Pick the break symbol on the line between the labels to add an elbow to the level line. Pick the upper, circular control grip and drag it to the left. Pick the lower grip and drag it the left while moving it up and down to the desired level. Rename Level 4 to U/S of Clg 1. Zoom out far enough to see all four level labels.
13. Type LL to create another new level. Choose the "Pick Lines" option in the Place Level draw panel. On the Options Bar, select the checkmark beside Make Plan View and place a checkmark beside Lock.
14. Pick the Plan View Types button on the options bar and in the Plan View types dialog, select only Floor Plan and pick OK. Choose the Pick Lines button and then pick the lowest horizontal edge on the building at the bottom of our floor. Pick the control grip by the level head and drag to the right until it is in line with the other levels.

15. Pick the Add Elbow mark on the new level. Drag the blue grips to the left until they are aligned with the elbow on the U/S of Clg level elbow. Pick the Level 6 label and rename the level to Grade.
 - a. With regards to naming this level, Grade, (instead of Top of Foundation) we are taking liberties with the construction norms by placing our floor directly at ground level. We'll be covering foundation walls in the next project and for now we are just setting a level at a reasonable location to cast shadows. 😊
16. Copy the U/S of Clg 1 level up 9 feet to the 18' elevation.
17. Zoom to Fit. Adjust the length of all level lines until they are aligned. Switch to each of the other three elevations and add elbows to the level lines where required. If the Roof level does not appear in any of the elevations, it is being hidden by the Crop Region for that view. If this happens, turn on the Crop Region visibility and drag the region shape handles up until the Roof level is inside the Crop Region.
18. Switch to the default 3D view. Move your cursor over one of the exterior walls and when it highlights, press the Tab key to highlight all of the exterior walls and pick to select the entire Chain. In the Properties Palette, under Constraints, in the Top Constraint field, choose Up to Level: Roof. The unconnected height grays out and shows 20' 0". Pick Ok. All of the exterior walls should now extend up to the Roof level.
19. Switch to the South elevation. Pick the Roof level and then change the elevation height from 20' to 24' and hit enter. Change it to 15' and then back to 20'. Because we have constrained the height of the exterior walls to the location of the Roof level, all of the walls will update whenever this level is repositioned. Switch back to the 3D View.
20. Pick one of the interior partition walls, right-click and choose Select All Instances. Pick the Element Properties button and set the top constraint Up to Level: U/S of Clg 1.
21. Switch to the Second Floor plan view. The exterior walls are already in place in this view and you can see the first floor elements shown in a halftone gray color from the underlay. Access the Visibility Graphic Overrides dialog by typing VG. In the annotation categories tab, clear the visibility for Elevations and pick OK to hide elevation markers in the view.

22. The items from another level's underlay can be selected and modified with the underlay visible if you enable the option to "select underlay elements" from the Select dropdown list below the Modify tool on the Ribbon. Check for this option and enable it. Pick one of the first floor interior



walls and from the Edit toolbar choose Create Similar. On the Options bar, clear the chain checkbox, and set the Height to U/S of Clg 2. Trace the two main North /South walls from the first floor. Draw one more wall which does not line up over any of the first floor walls, from left to right across one of the three main sections. Use the Align tool to move the new wall into alignment with the closest wall on the first floor. When they are aligned pick the Lock icon to create locked constraint between the walls on the different floors. Now, if you move one of the walls on one floor, the corresponding wall on the other floor will move as well.

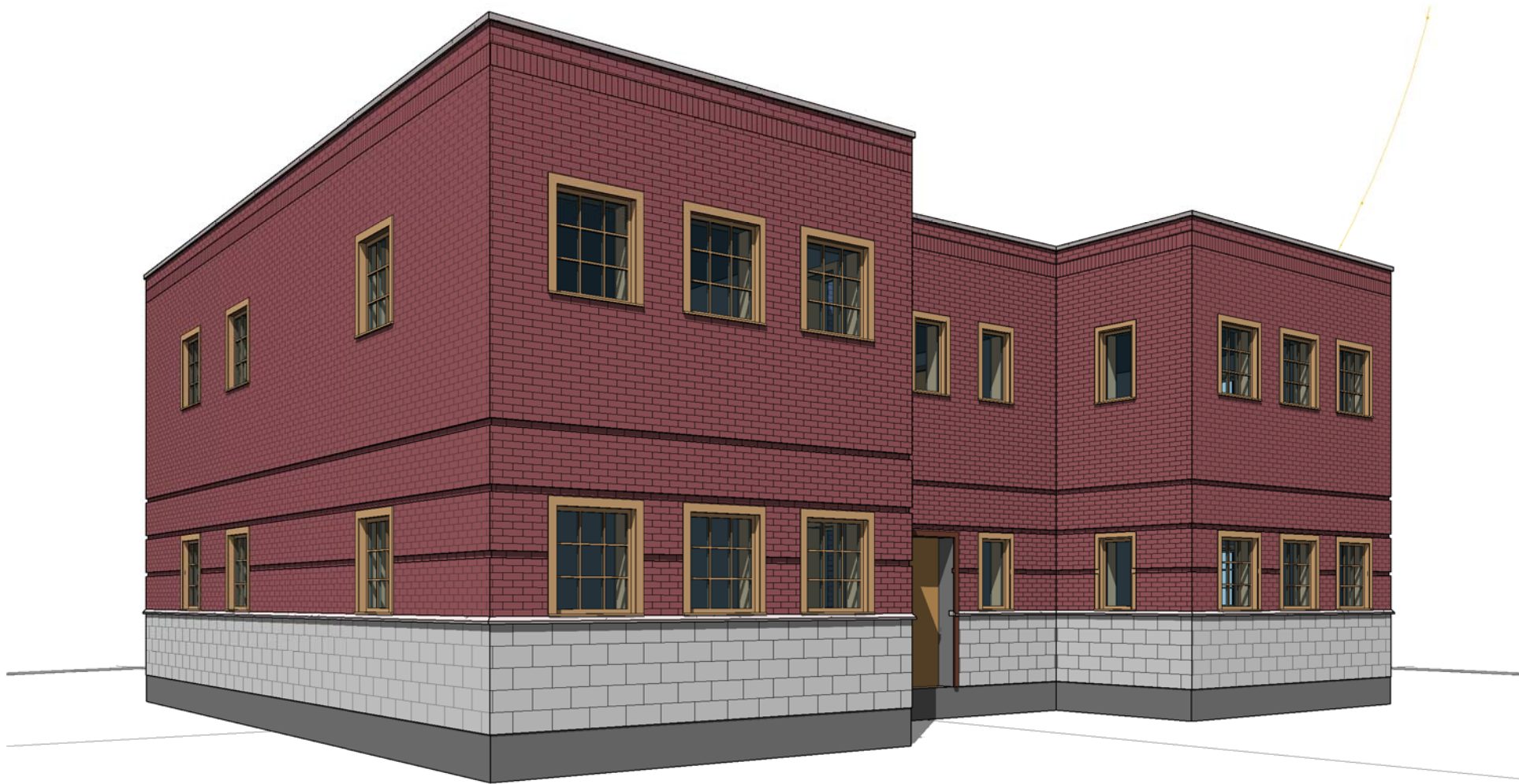
23. In the Properties palette, set the Underlay field to None. On the Build panel of the Ribbon, choose the Floor tool. Use the Pick walls option with the Offset at 0" and Extend to Core selected. Move your cursor over one wall, press Tab, and pick to select the Chain of exterior walls. The sketch line should appear roughly in the middle of the wall. In the Floor Properties dialog, set the Floor type to Wood Joist 10" – Wood Finish. Pick the green checkmark to Finish the Sketch. Choose Yes when prompted to Join the Floor to the Wall where they overlap.

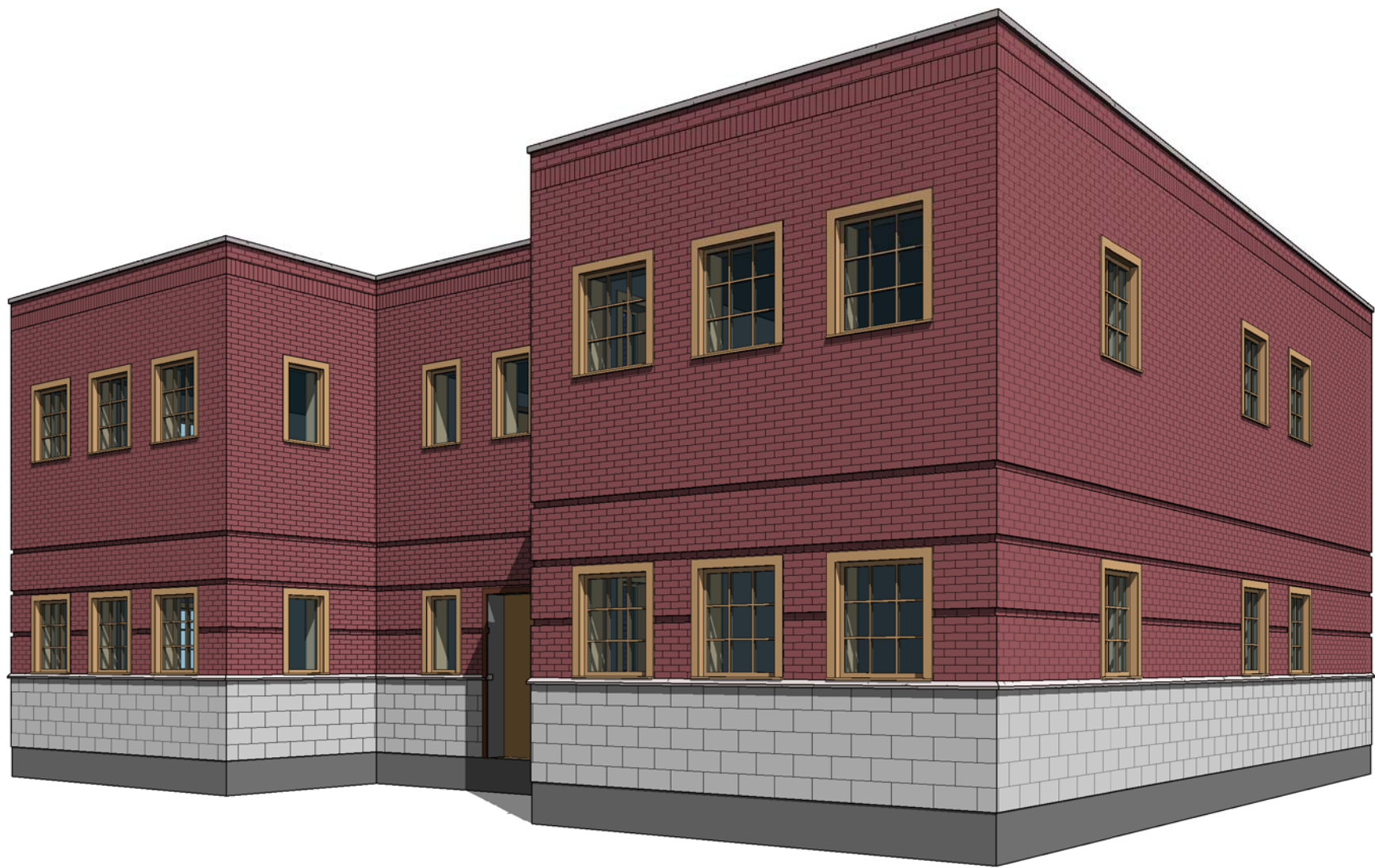
24. Switch to the Roof plan view. On the Build panel of the Ribbon, choose Roof / By Footprint. On the Options Bar, clear the check box by Defines Slope. Leave the overhang at 0' 0" and clear the Extend to Wall Core option. Choose the Pick Walls option and select the exterior walls, one at a time, by picking along the inside edges. The Chain selection method does not always work to pick up only the edges you need.
25. Pick Edit Type and In the Type Properties dialog, pick the Steel Truss – Insulation on Metal Deck – EPDM roof type. In the Type Parameters you can see that the thickness of this roof is 1' 9 ½". By default this distance will be measured upwards from the base level for the Roof. If we want the top of this flat roof to be at our Roof level, we can set a base offset = to the roof thickness. Pick OK and change the base offset distance to *negative* 1' 9 ½". Pick the Finish Edit Mode checkmark to Finish creating the Roof.
26. Switch to the 3D View. Zoom in around one corner of the roof and you can see that our parapet wall section only extends the thickness of the Capstone above the roof. Pick one of the exterior walls, right click and choose Select all instances. Open the Element Properties and set a Top Offset distance of 1' 6" above the Roof. Pick Ok. The walls now extend 18 inches above the surface of the flat roof. Zoom to Fit.
27. Switch to the South elevation to view the new appearance of the building. Let's add some more windows to the second floor but first we're going to add a couple more along the front of the building and get some practice with Copy and Mirror at the same time.
28. Switch to the First Floor Plan. Zoom in on the front of the building where a single window is placed in each of the front walls. Pick one of the windows, choose Copy from the Modify panel and then pick two points to copy the window 5 feet to the left. Select the copied window and choose the Mirror command from the Edit toolbar. Pick a mirror axis in the middle of the original window and it will create a third window in that wall.

29. Zoom out until you can see the entire width of the building. Press CTRL, and pick the two new windows. Pick the Mirror tool again and choose a mirror axis in the middle of the front door. This will mirror the two windows from one front wall to the other so each of the front walls have three openings. Switch back to the South elevation. Better, but we need some nicer windows. In one operation we'll load a new family, make a new type, and assign instance parameters to an entire set of windows. 😊
30. Switch to the 3D view again. Pick one of the 3 foot windows, right-click and choose select all instances. Pick Edit Type to open the type properties. Beside the Family name, pick Load. In the Open dialog, browse to the Windows category and pick Casement 3x3 with Trim and load it into the current project.
31. We can create a new type for the 42" height we are looking for at the same time we are loading the new family. Pick Duplicate. Name the new type 36" x 42" and change the Height accordingly. Change the Window Inset to 3" and pick Ok. Set the Sill height to 42.75 inches and pick Ok. All of the 3 foot windows will shift up slightly and redraw with the new appearance. Repeat the process for the two foot windows, loading in a 24" Fixed with Trim family.
32. Check the window sill heights for either the 3 foot window or the 2 foot window and you will see that they are still using a sill height of the 42 inches. Pick one, type SA to select all instances, and then adjust the height to 42.75". Repeat for the second window type.
33. Zoom to Fit in the 3D View. Drag a large selection window around the entire building. Pick the Filter icon from the Selection panel and choose the Check None button. Put a check mark by Windows and pick Ok. On the Clipboard panel pick the Copy to Clipboard option or press CTRL-C. From the Paste dropdown, choose Paste Aligned to Selected Levels. Choose the Second Floor Level and pick OK. 😊
34. Add one more window on the second floor, directly above the Front door. Now that we have new windows, floors, roofs, and elements constrained to levels we are going to make a few perspective views and then start laying out Sheets.
35. Switch to the Grade level and zoom out so we have some white space around the building. From the View tab on the Ribbon, choose the Camera Tool. (Create - 3D View dropdown)

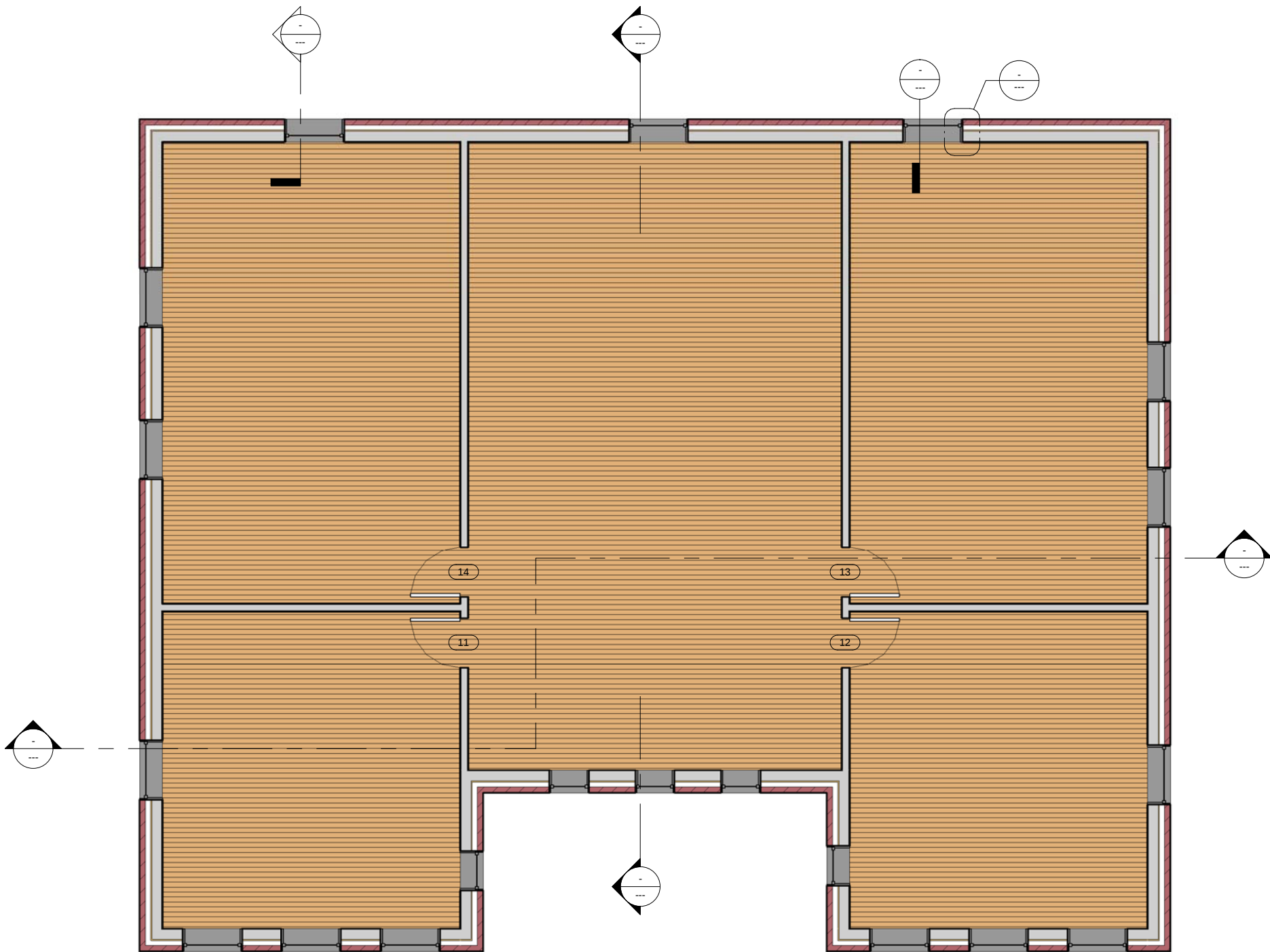
36. On the Options bar, confirm the Offset (camera height) is set to 5'6" (a typical eye-level) from the Grade level. Pick a point below the building and to the left to define the camera position and then drag your mouse all the way to the far side of the building. A blue triangle appears indicating the field of view for the image. If the triangle is not wider than the building, but intersects the exterior walls, that part of the building will not show in the perspective view. Pick a second point to define the target location for the view and Revit will open the new perspective view.
37. In the Project Browser, rename the 3D View 1 to SW Perspective. From the View toolbar, choose the Steering Wheel icon to open the Steering Wheel. If you are too close to the building to see the entire extents use the Walk tool on the steering wheel to walk backwards with the Camera. Pick and drag in the direction you want to walk. The further you drag your mouse in one direction, the faster the view will change. After adjusting the camera position, choose the Look tool on the Steering Wheel and then pick and drag in the direction you want to point the camera. Do not orbit, zoom or pan in your perspectives.
38. On the View Control Bar enable shadows, set the Sun Path to On, and then open the Sun Settings dialog. Under Solar Study, select Lighting and then in the Presets area, select Sunlight from Top Right. Pick Apply to view the effect of the lighting in the view without closing the dialog box.
39. Change the preset lighting direction to Sunlight from Top Left. Pick Apply. Under Settings, change the Azimuth value to 200. Enable the Ground Plane option and set the Level to Grade. Pick Apply again to view the new lighting angles.
40. Under Solar study pick Still. In the settings area, pick the Browse button by location. In the Location tab, choose Define Location by Default City list. In the City dropdown, pick a city that is close to your location and pick OK. Set the date to the current date. Set the time to 9:00 AM and pick Apply to view the new lighting. Experiment with a few more times, and then set it at 2:00 pm and pick OK.
41. Repeat steps 36-42 and create two or three more perspective views looking at the other corners of the building. Name the views descriptively to aid in navigation and managing the views. Try to set up your lighting so that the sides of the building that you are viewing are not in shadow.

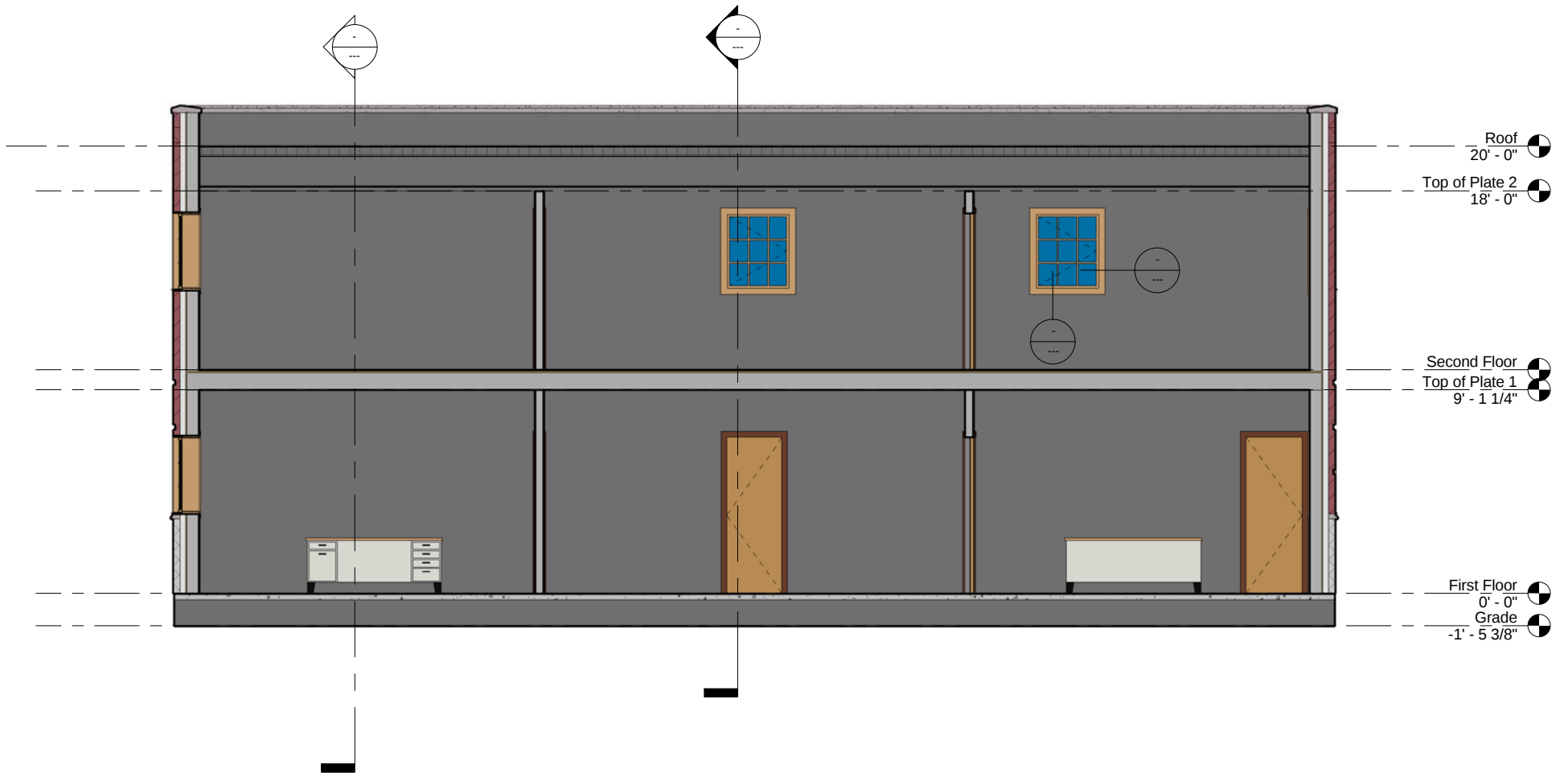
42. In the Project Browser, right-click on the Sheets category and pick New Sheet. In the Select a title block dialog, pick Load and browse to the Title blocks folder. Choose the C 17 x 22 Horizontal family, pick Open to load it and then pick OK to create a new sheet.
43. In the Project Browser, expand the Sheets Category and you'll see the active view called A101 – Unnamed. Look in the title block and you will see that sheet is also labeled Unnamed and its number is A101.
44. Zoom in on the title block and select it. All blue fields may be edited directly on the Sheet. Set the Issue date to the current date. Put your initials in the Drawn By field and put KB in the Checked By field. Change the Sheet Number to A-1 and replace Unnamed with Floor Plan. Change Project Name to Meadow Centre and replace the Client Name with Green Inc. Set the Project Number to 2016_001. Zoom to Fit.
45. From the Project Browser, pick and drag the First Floor view on to the new sheet. Center the blue rectangle on the sheet and pick a point. Select the control grip at the end of the View title and drag it to a shorter length. Pick outside the view to clear the selection.
46. Zoom in around the view title and if required, pick it and drag it into the desired position. You may prefer to align the view titles with the edge of the building whereas Revit will place it by default at the view extents.
47. Zoom to Fit and save your project. Back up your work as usual and we will continue to develop our set of Construction documents in the next lesson.

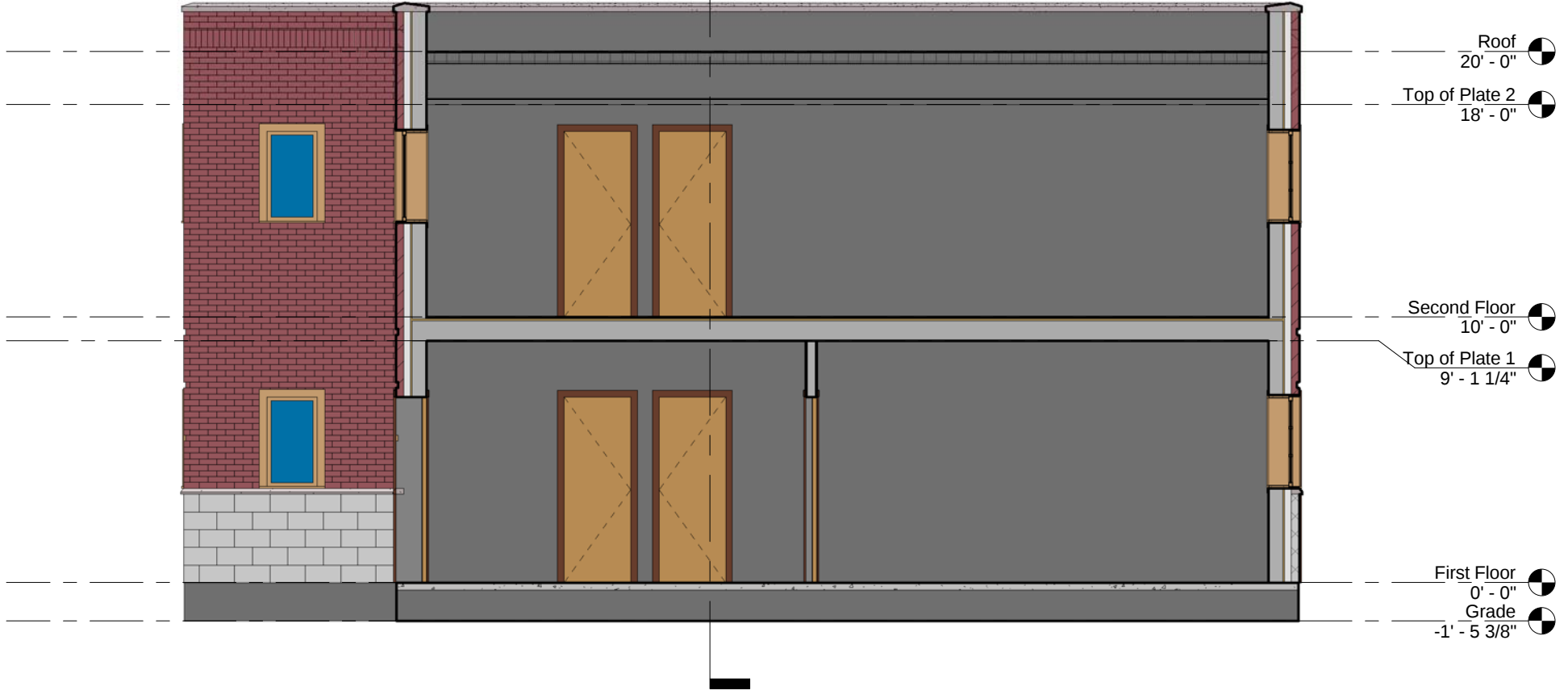












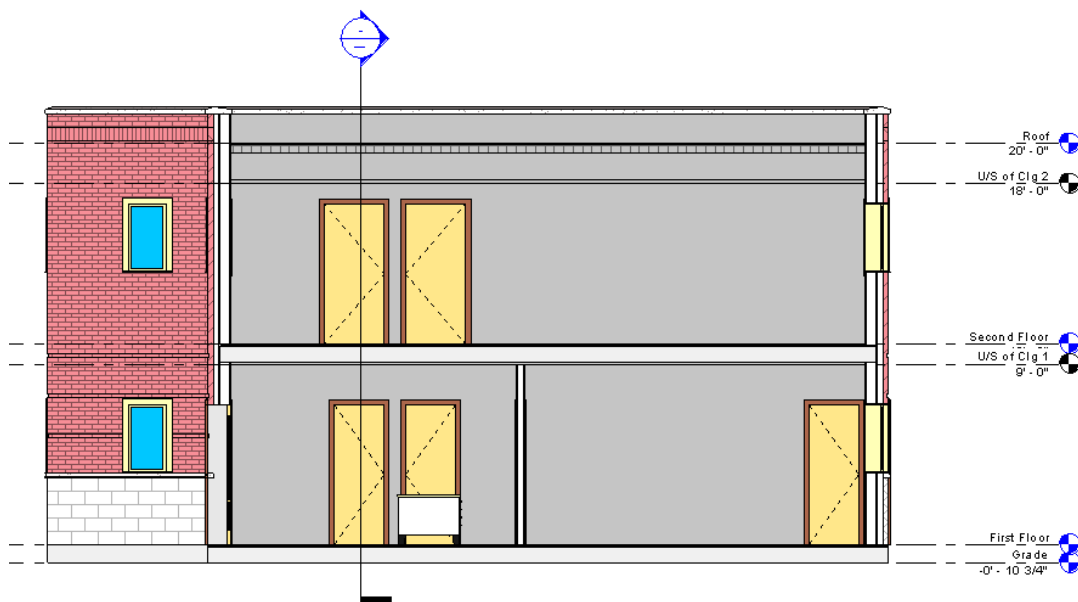
AGENDA:

1. Section Views – Building Sections, Wall Sections, and Detail Sections
2. Callout Views

1. Section Views

Section Views allow you to define a cutting plane through your building model. Sections may be created in Plan or Elevation Views as well as in other Section Views and Detail views.

Sections allow you to take a slice through your model to create full Building Sections, Wall Sections, and Detail Sections. Each of the three main types of Sections has its own graphic display settings and they may be grouped in separate categories in the Project Browser.



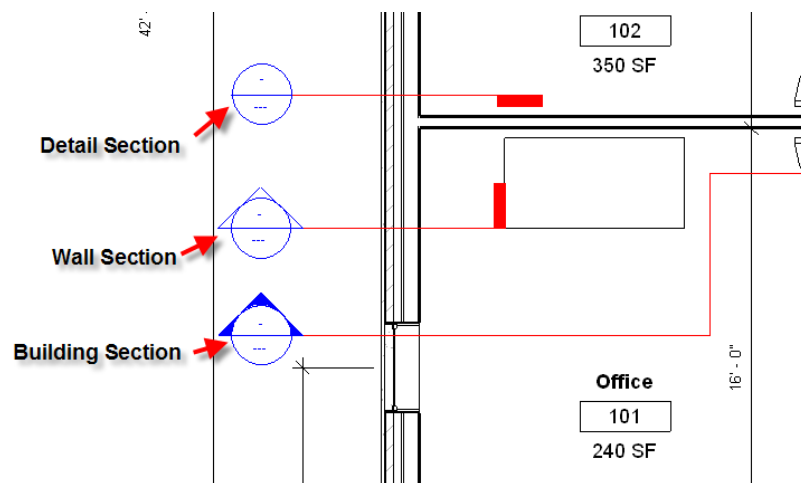
Sections are created by choosing the Section tool on the View Tab, choosing the Section Type in the Type Selector, and then picking two points to define the extents of the section box as it cuts through the building.

Building Sections will be listed in the Sections category in the Project Browser. The Section line for a Building Section extends across the entire building.

Wall Sections may be defined in a plan view, with their own Section Line which will extend only a short distance on either side of one exterior wall. Wall Sections are shown with a different type of Section head than a full building section and to vary the appearance, should be set to the Wall Section Type. Wall sections defined with this method will be listed in their own Wall Sections Category of the Project Browser.

Detail Sections may be defined in Plan, Elevation, or Section Views. Use the Section tool with the Type set to Detail and pick two points to define the extents of the Section. Detail Sections are grouped together in the Detail Views category in the Project Browser.

If you add a detail type section line in a plan view, it will create a Section detail which technically speaking is a vertically oriented view. If you add a detail section line in a Section or Elevation view, the orientation of the section line will determine if the resulting view is a Detail Section or a Plan Detail. Plan Details are horizontal “section” views which are defined by drawing a horizontal section line in an elevation or section view.

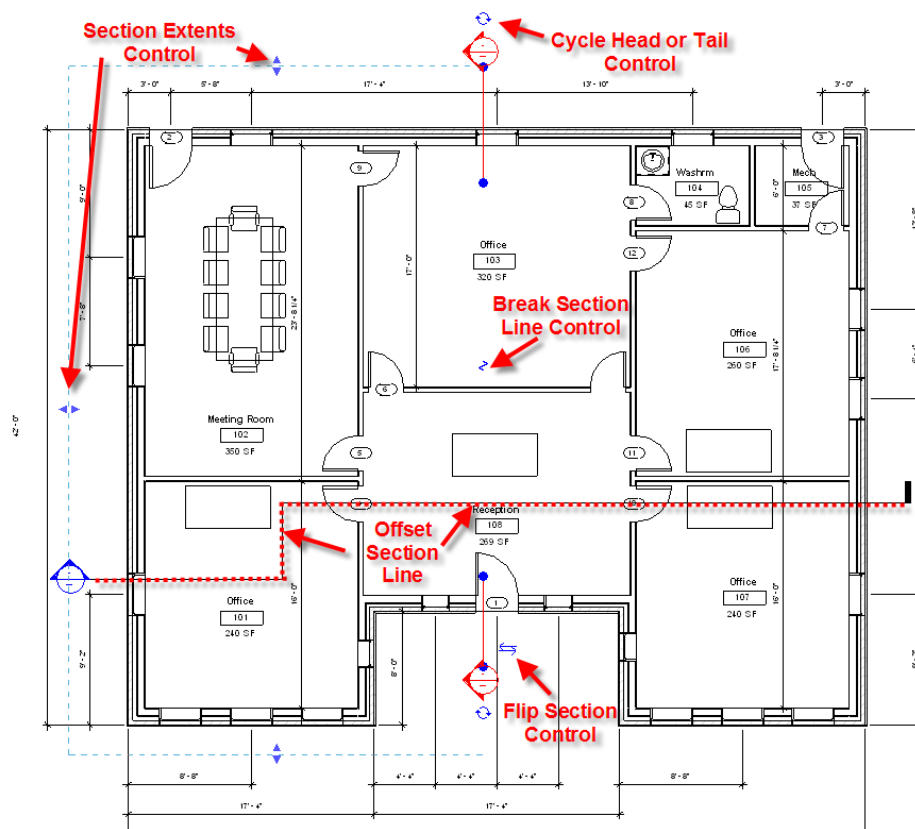


The Section type controls the appearance of the Section head and section tail. If you want the appearance of a section head or tail to change as shown above, choose a different section type in the Type Selector.

When you draw a section line, you can reverse the viewing direction for the section, indicated by the arrow on the section head, with the flip controls shown beside the Section line.

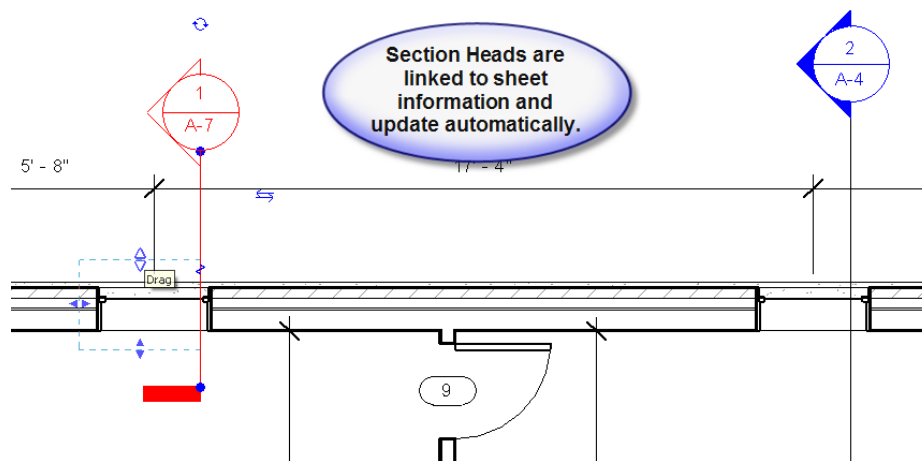
When you add a section line, by default the first point you pick will be shown with a Head and the second point will define the Tail location. If you select a section line after you have created it, several controls allow you to manipulate the appearance of the section line. At each end of the section line, a pair of blue circular arrows allows you to cycle through the available options for displaying the head symbol, the tail symbol, or no symbol at all. This will allow you to show a Head at both ends of the section line for a building section.

Other controls on the Section line include a break symbol on the line itself which will allow you to hide the middle portion of the section line. This can be useful if you want to create a building section but only show the section line extending a short distance through the exterior wall on either side of the building. To restore the break line, click the symbol again.



To create an Offset section or Jogged Section line, use the Split Segment tool on the Ribbon to define a split point in a selected Section Line. After splitting a section line you can drag the line on either side of the split as required to cut through different elements.

Revit uses a default depth and width for the extents of a section but this can easily be modified by selecting the Section line and then dragging the control grips on the dashed blue line which defines the section box dimensions. The Section Head and Tail can be repositioned independently of the Section extents box. This lets you reduce the size of the section view without moving the Head too close to your building.



The Section Head will display the detail number and sheet number only after you have added the Section view to a sheet. The annotations will be linked so they will automatically update if the sheet information changes.

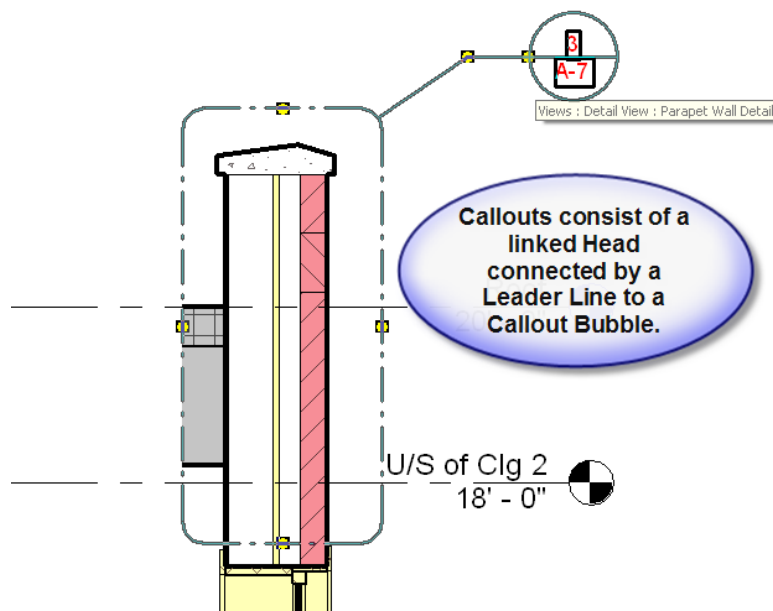
When you add Section lines in a plan view, they will also be visible in elevation and other section views. Section heads always display in blue, indicating that they are linked to other views. If you double-click a Section head, it will switch you to the linked Section view.

Sections will automatically be named to Section 1, Section 2, etc. Right-click on the view name in the Project Browser to rename the sections to Longitudinal Section for the longest section through the building and Cross Section for the shorter cut through the building.

If you select a section line and check the properties palette, you can modify the view properties for the linked section view including scale, shading, detail level, etc. When you switch to that view all settings will be updated.

2. Callout Views

Callout Views allow are details views which reference an enclosed area of an existing view at a larger scale. Callouts allow you to create progressively larger scale details that will be linked to the view in which they are created. By default, the callout view scale will be double the scale of the view in which the callout is defined.

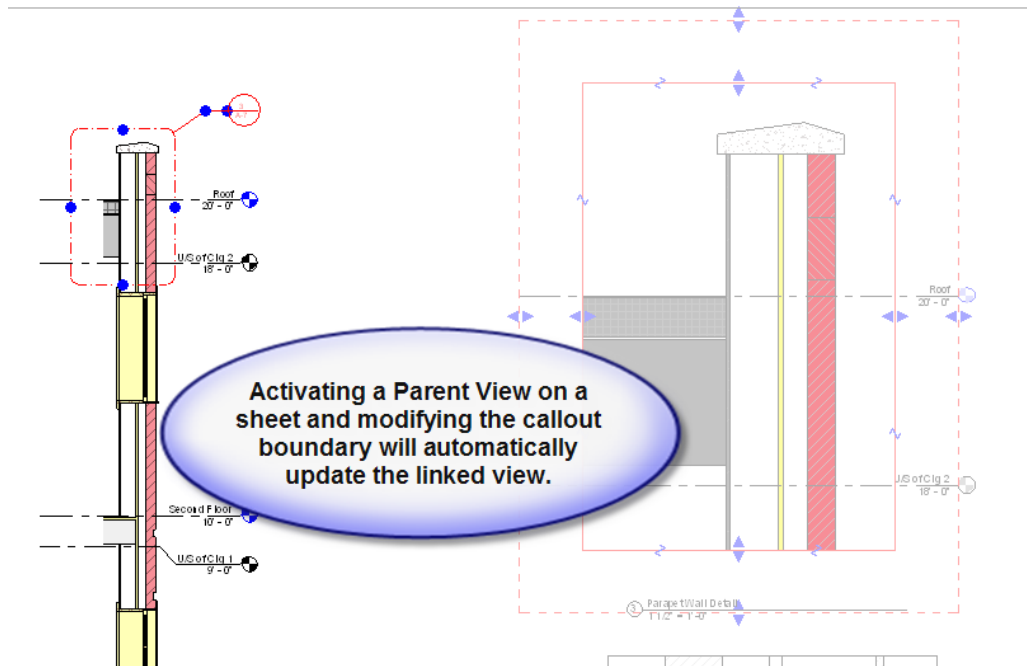


The View in which a Callout is defined is called the Parent view for a callout. The callout will be dependent on the parent view and will be deleted if the Parent view is deleted.

Callouts can be defined in Plan, Section, Detail, or Elevation views. The Callout types available in the Type Selector will vary with the current view. There will always be a View type callout corresponding to the current view plus a Detail Callout.

The different types of callouts help you organize the location of the callouts in the Project Browser. For example, if you create a callout view of a washroom in a floor plan view, setting the callout type to Floor Plan will place the new view in the Floor Plans category. If you create a callout in a Section view, you can choose to place the resulting callout in the Wall Sections category or in the Details Category, whichever is more appropriate based on the scope of the callout.

Callout Bubble boundaries define the size of the resulting callout view and the boundaries of the building elements being displayed. When you adjust the size of the callout bubble, all linked views will automatically have their crop region adjusted to match the new displayed area within the Callout Bubble. If the parent view is on the same sheet as the linked view, you can see the size of the detail view change as you modify the callout boundary.



The relationship between the Callout Bubble and the linked view is bidirectional. If you activate the dependent view and modify the size of the Crop Region, it will automatically update the size of the Callout Boundary in the Parent view.

To modify the position of the Callout Head, pick the callout, select the control grip attached to the head, and drag the Head around the callout bubble. The leader line will follow the head and stay attached to the bubble. To modify the shape of the leader line use the control grip on the leader line itself. Zoom in close to the leader line and it will be easier to get it to snap to a horizontal orientation as it attaches to the Head.

Exercise Notes

In the following exercises you will practice creating building sections, wall sections, detail sections and callout views. You will continue to develop your Construction Document set by laying out all remaining views on sheets.

1. Open the project you have been developing over the last few classes. Set the First Floor plan view active. Zoom to Fit.
2. From the View tab of the Ribbon, choose the Section tool. In the type selector, set the type to Section: Building Section. Pick a point just below and in line with the Front door, and drag your mouse all the way through the building, cutting through the door at the Front and the window at the back wall. Pick the Flip arrows to flip the direction of the section and then flip it back.
3. If the section line is overlapping the dimension witness line to the window in the back wall, select the section line and move it a few inches to one side. With the section line still selected, use the Cycle Section Tail control arrows at the top of the view to toggle through the available appearances for the tail. Set it so you have a full Head at both ends of the section.
4. In the Project Browser, a new category has been created called Sections. Expand this category, right-click on the Section 1 view, and rename it to Cross Section.
5. Double-click the Section head at either end of the Section line and it will take you to the Section View. Depending on the location of the first point you picked when you drew the section line, the portion of the building which is in an elevation style view at the left side will show a different amount of wall. The scope of the section view is controlled by the extents of the Section boundary. Switch back to the First Floor view. Set the detail level to medium and the visual style to Shaded.
6. Pick the Section line to display the blue dashed line defining the Section extents box. Pick the blue control grip on the bottom horizontal segment and drag it downwards until it is a foot or so beyond the lowest exterior wall. Select the segment at the top and drag it down until it is just a few inches from the top wall. Pick in an empty area to clear the selection.

7. Double-click the section head to switch back to the Section view. This time, the entire building length should be depicted. At the right side, though, the level labels might be a bit too close to the building because we moved the section extents line at the back of the building close to the wall. We can modify its position in this view by adjusting the crop region.
8. On the View Control Bar, choose, Show Crop Region if it is not being displayed by default. Pick the Crop region and then drag the control grips on the right side further away from the building. Adjust the length of the level lines if required. Pick the grips defining the upper and lower extents of the crop region and pull them closer to the building at the top and bottom. This will reduce the size of the view when we place it on a sheet.
9. Zoom in on the Section where you can see the top of a first floor interior wall and you will notice a gap between it and the floor object. Because our second floor object has an actual thickness of 10-3/4" our partition walls are not reaching to the underside of the joists. Use the Align tool to bring the U/S of Clg level line into alignment with the underside of the floor. (9' 1-1/4")
10. The tops of the frame walls are now touching the bottom of the joists in the floor. Since the ceiling is actually going to extend down from the joists as well, let's rename the U/S of Clg 1 and 2 levels to Top of Plate levels. Top of Plate 1 and Top of Plate 2.
11. Double click the First Floor level head to switch back to the First Floor view. Select the section line to define its extents relative to the position of the Section Heads. The latter can move independently by using the control grips where the head connects to the section line. Adjust the heads so they do not interfere with any dimension lines. Adjust the length of the dimension witness lines if necessary.
12. Add a second, Building Section line starting on the left side of the building and cutting all the way through to the other side. Drag the section line through one of the windows on the left side of the building. Cycle the tail display to change it and show a head at both ends.
13. Select the Section line and from the Section panel on the Ribbon, choose Split Segment. Pick a point just to the right of the main North-South interior wall and then drag your mouse up until the offset segment is passing through the interior door opening of the second office to the North, before continuing through the other side of the building. In the Project Browser, right click on the new view and Rename the section from Section 1 to Longitudinal Section.

14. Double-click the Longitudinal Section view to make it active. Adjust the Crop region and adjust the position of the level labels to bring the region border close to the building. Turn off the Crop Region display when you have finished adjusting the region shape. Set the detail level to Medium and the graphics display to Shaded.
15. The Section line for the Cross Section is correctly displaying in this section view and its head and tail should be quite close to the building. If you pick the Section line, it displays its extents box and control grips allowing you to adjust the position of the Head or tail if required. If you would like to hide the section line in this view, you could use visibility controls to hide the category or the selected element. You can also use a property called "Hide at Scales coarser than..." to control the visibility.
16. With the section line selected, check the value for the Hide at Scales property. It should be $\frac{1}{4}"=1'-0"$ which matches our view scale. Change the value to $\frac{3}{8}"=1'-0"$ and the section line will disappear. Change the value to $\frac{3}{16}"=1'-0"$ and the section line will reappear. This value is linked to the scale shown the view control bar for the current view. $\frac{1}{4}"=1'-0"$ is coarser than $\frac{3}{8}"=1'-0"$ and thus the section line is hidden as per the Hide at Scales setting. Set the value back to $\frac{1}{4}"=1'-0"$.
17. Double click the section line head to switch to the Cross section. In this view you can see the Section line for the Longitudinal Section. Adjust the position of the head and tail for this section line as well to bring them closer to the building. Set the detail level to Medium and the graphics display to Shaded.
18. Switch to the Floor Plan View. The offset section should show its path as it cuts through the building but the first section line we created can be shown with the middle section broken out. Pick the first section line for the Cross Section and pick the break symbol on the section line. Adjust the length of the remaining segment lines as desired by dragging the control grips on their endpoints.
19. Try toggling the break symbol on the jogged section line just to see how it is handled and then pick it again to toggle it back to a continuous line.

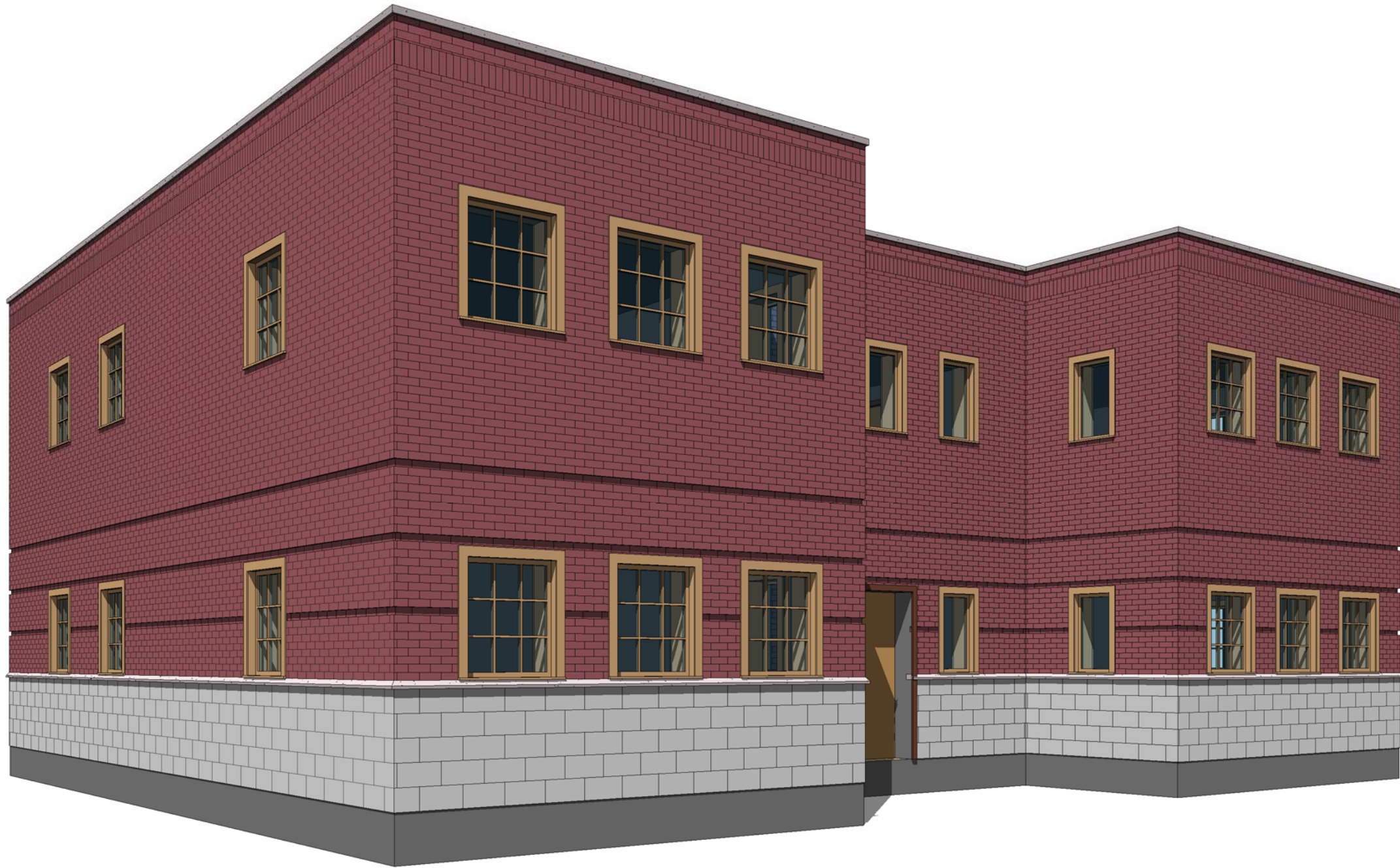
20. Speaking of Continuous lines, it might be nice to know how to adjust the line type for the section line as they are often shown with a center line type instead of continuous. This type of change is setup as a global control for the entire project and is set in the Object Styles. From the Manage Tab on the Ribbon, choose Object Styles. Select the Annotation Objects tab and scroll down to the Section Line category. In the Line Pattern column, to the right of Section line, pick Solid and change it to Center 5/8". Pick OK to close the dialog and apply the change.
21. Zoom in to the Meeting Room in the upper left of the Plan. From the View tab, choose the Section tool and in the Type selector, choose Section: Wall Section. Pick a point above the window in the back wall and drag a short section line down through the window and into the meeting room. Flip the section if necessary so it is viewing to the left side.
22. Adjust the extents of the section box to a small rectangle about a foot and a half square. Adjust the position of the head and tail to fit close to the wall. If required move the dimensions away from the building to avoid any interference with the Section lines. Alternatively, you can drag the section head to the outside of the dimension string. All annotations must read clearly and section heads should not overlap the dimension line or extension line.
23. Double-click the section head for the new wall section to set that view current. In the Project Browser, expand the new Sections (Wall Section) category and rename Section 1 to Wall Section W1.
24. Pick the Section view to display the Crop Region and adjust the perimeter as required to bring the top and bottom closer to the building elements and to adjust the position of the level labels relative to the wall.
25. Pick the level lines, ensure that the 2D toggle is enabled and drag the open ends of the lines into the left edge of the crop region. Set detail level to medium and the visual style to shaded.
26. Set the Longitudinal Section view current. Adjust the positions of the wall section head and tail to pull them into alignment with the head and detail of the Cross Section view.
27. In the upper right corner you should see a room with a 3 foot window shown in elevation on the back wall. Zoom in to this area on the section view.

28. From the View tab, choose Section and in the type selector choose Section: Detail View. Pick a point about a foot below the sill and drag your cursor up into the middle of the window. Cycle the visibility of the section tail to off.
29. Pick the section line and drag the width of the section box so it extends just outside of the window. In the Properties palette, set the scale to $1\frac{1}{2}'' = 1'-0''$.
30. From the View tab, choose Section and in the type selector choose Section: Detail View. Pick a point to the right of the window and drag your mouse horizontally to define a Plan Detail cutting through the window jamb. Hide the section tail and adjust the size of the section extents so it extends below the window.
31. In the Project Browser you have a new Category called Detail Views. Expand this category and rename Detail 0 to Window Sill Section. Rename Detail 1 to Window Jamb Detail. Even though we created this detail with a section line, it is actually a plan detail and not a true section view, which by definition is a vertical cut through one or more elements.
32. Switch to both of the detail views and adjust the views if required. Set the detail level to medium and fine-tune the size of the detail crop region.
33. Switch to the Wall section view and zoom in on the top of the section around the roof. From the View tab on the Design Bar, choose Callout and pick a point just inside the wall, below the ceiling but above the window. Drag up and to the right to define a rectangular callout region that encompasses the top of the wall and capstone.
34. Pick the callout bubble to select it and then reposition the callout head by dragging the control grip located at the quadrant of the Head. Drag the head up and to the right above the callout bubble. Pick the control grip on the leader line, zoom in and drag the grip up to create a horizontal section of leader where it attaches to the callout head.
35. In the Detail Views section in the Project Browser, rename the new view from Detail 0 to Section thru Parapet Wall. Okay.
36. Switch to either of the Building Section views and zoom in to the lower right corner where the exterior wall is overlapping the floor system. We will not be drawing the foundation walls for this project so we will edit the floor boundary to extend to the face of the brick. Pick the floor and choose Edit Boundary. Select the first floor view for editing the sketch. Tab-select the entire chain of sketch lines and then set the offset value on the option bar to 7". Finish the Sketch.

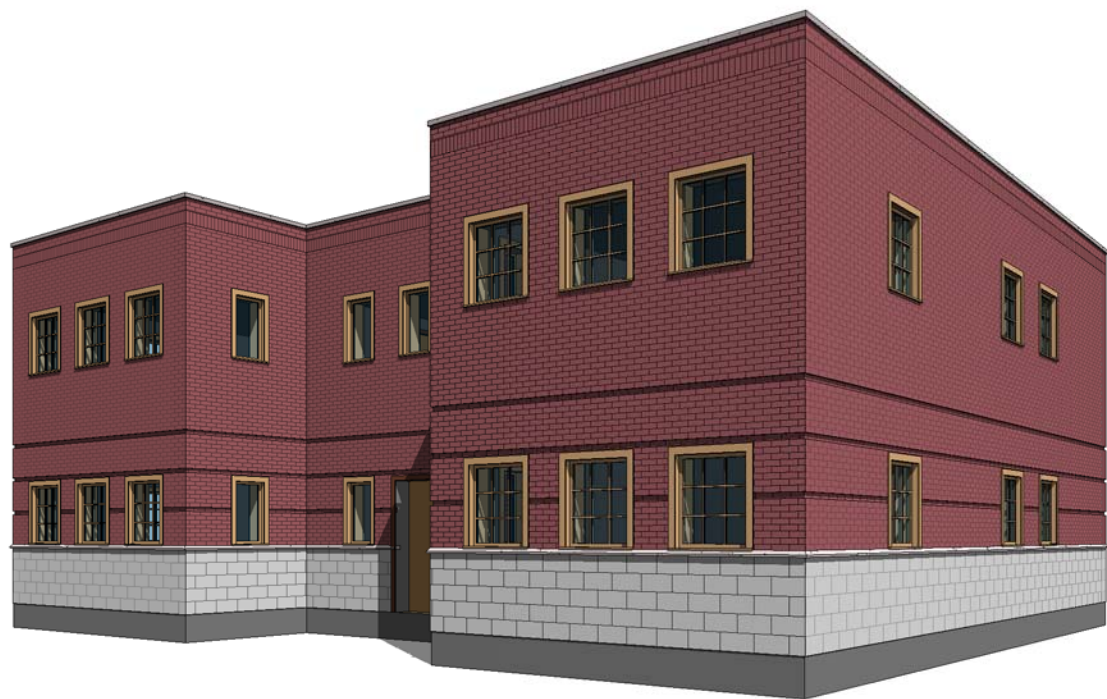
38. Time to clean up the views and lay them out on sheets. Switch to First Floor view and confirm all section lines and heads are positioned correctly. Switch to the Second Floor View. Set the scale to $3/16"=1'-0"$ and then set it to $1/4"=1'-0"$ to see how the annotations will hide and display based on the scale.
39. At $1/4"=1'-0"$ this view displays all of the full section lines and the wall section line plus it also shows the two detail lines around the window in the back wall. Zoom in around this window. Revit has cleverly added these annotation symbols showing the section through the sill with a section line and tail and the plan detail with a callout bubble. Pick the callout bubble and reposition the leader and callout head so they are displayed outside the wall. If the tail and head are displayed on the wrong sides of the wall, use the cycle controls to get the head on the outside of the wall. Leave the section tail visible in this view. If you have not yet added doors to the walls on this floor, do so now. There should be four doors.
40. Switch to the Elevation views one at a time and adjust the position of the Building Section and Wall Section heads and tails so they are close to the building. Use the Override Graphics in View / By Element to hide the display of the two detail section lines through the window on the second floor. Check all of the new section views and detail views to confirm they are being displayed correctly. (scale, detail, model graphics, extra symbols hidden, etc.)
41. In the Sheets category, switch to A-1 – Floor Plan. All of the section lines have already been added and are up to date on the sheet. Let's renumber this sheet from A-1 to A-2 so we can use A-1 for a sheet with Perspective views. Right-click on the sheet name and choose Rename. Change the Sheet number to A-2 and the name First Floor Plan.
42. Right-click on the Sheets Category and create a new sheet with the C-size layout we used for the first floor plan. Note how all of the project specific information we entered on the first sheet has been added automatically to the new sheet. Note also, how the sheet has automatically been numbered to A-3, following the convention of our other sheet. Rename the Sheet to Second Floor Plan.

43. From the Project Browser, drag the Second Floor View on to the sheet. Drag the view into the centre of the sheet by picking and dragging if required and shorten the length of the View title extension line. Zoom in on the View title. The Name on the title is the same as the view name. If we edit the name of the view directly on the title it will rename the original view as well. To display a different name on the sheet, enter it in the Title on Sheet field in the element properties for the selected view.
44. Move your mouse over the viewport and pick it. Right click and choose Element Properties. Under Identity Data, enter Second Floor Plan in the Title on Sheet field. You can also rename the actual view name in this section if you wish. Scroll through the other options in this dialog. Any changes you make here are affecting not only the view on the sheet, but the original working view as well. The sheet views are merely a snapshot of the working views.
45. Create two new sheets called A-4 - Elevations and A-5 – Elevations. Set A-4 Current and add the South View at the top of the sheet and the East view at the bottom. Move the view titles so they are in line with the edge of the building a bit closer to the bottom edge on each view. Then, move one view so its view title aligns with that on the other view. Repeat on Sheet A-5, adding the North elevation at the top and the West elevation aligned below.
46. Create a new sheet called A-6 - Building Sections. Drag the Longitudinal Section view on to the top of the sheet and the Cross Section view on the lower half. Move the view titles and then move the views to align the titles.
47. Review the four elevations and both sections to see how the level lines are displaying. If you need to add elbows to any of the level lines, pick the viewport, right-click and choose Activate View. This will allow you to edit within the context of the sheet view. When you have finished making changes, right-click over the viewport and choose Deactivate View or just double click outside the view.
48. Create a new sheet and rename it to A-7 – Wall Sections and Details. Drag the Wall Section view on to the left side of the sheet. The scale should be set to $\frac{1}{2}'' = 1'-0''$. Adjust the view title position if required. Activate the view and hide the Crop Region display.
49. Expand the Detail Views in the Project Browser and drag the Section thru Parapet Wall view on to the top right section of the sheet. The scale should be set to $1 \frac{1}{2}'' = 1'-0''$. Adjust the view title position.

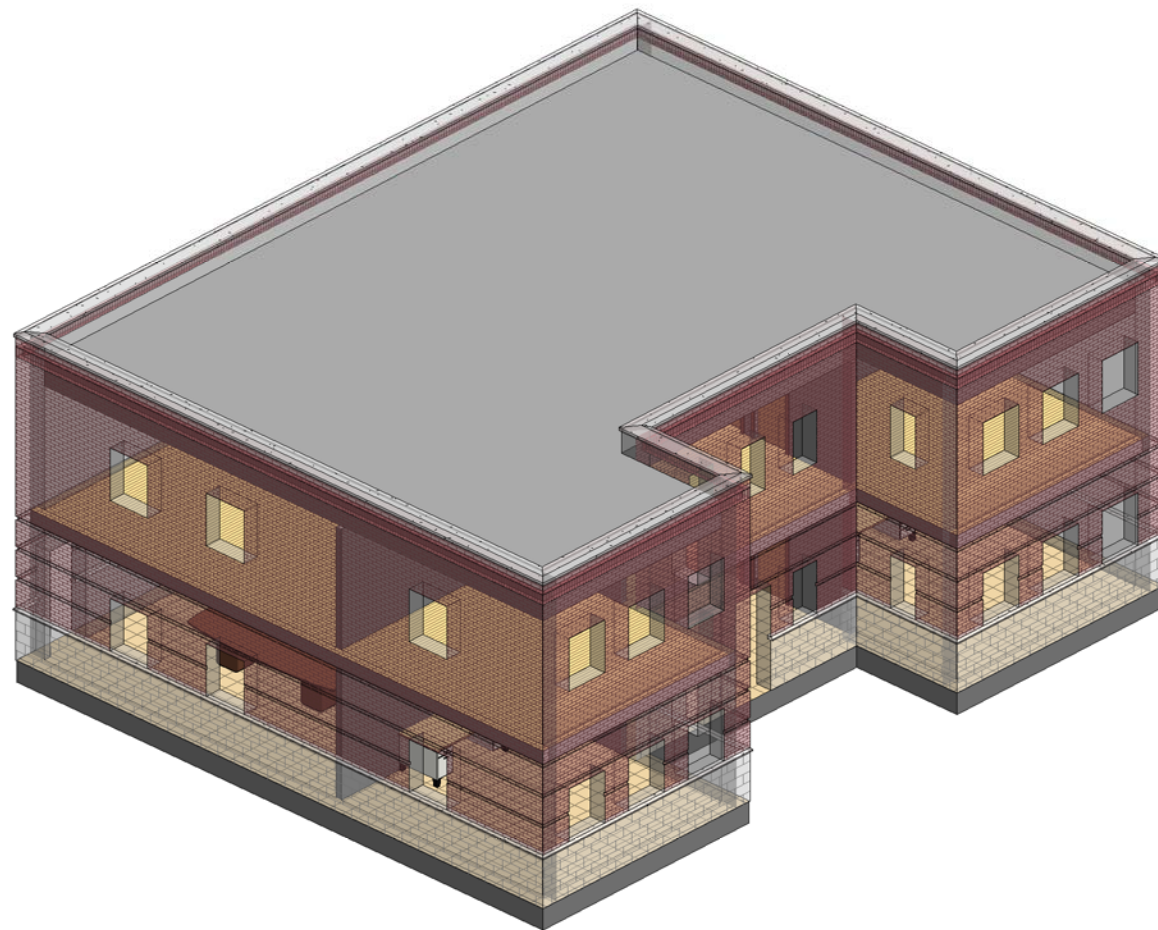
50. Select the viewport for the Wall Section, right click and choose Activate View. Create a new callout around the intersection of the second floor and the exterior wall. Rename the view to Section thru Floor at Wall. Deactivate the wall section viewport and drag the new detail view on to the sheet below the Parapet detail. As you move the lower detail back and forth a smart alignment line will appear when the core of the wall below is in line with the core of the wall above.
51. Create a new sheet called A-8 – Window Details. Drag the two window details on to this sheet. Change the scale for the two detail views to $3'' = 1'-0''$. Switch to the Cross Section and create a callout view through the head of a window in the sectioned wall at the right side. Rename the view to Window Head Section. Activate the new view and hide the section annotation category. Add the new callout view to the Window Details sheet.
52. Create one more sheet called A-1 – Perspectives. Add your favorite perspective view of the front of the building on the top half of the sheet. If the view needs to be resized, pick the viewport and choose the Size button on the Options bars. Choose lock scale and set the width you wish the view to cover on the sheet.
53. Add two more perspectives or 3D views at a smaller size in the lower half of the sheet. Arrange the titles below the views and then activate each view in turn and turn off the Crop Region if it is visible.
54. Review your sheets one more time for any adjustments that are required and to finish filling in the sheet specific title block information. Make sure that you are using a consistent level of detail (medium) and a consistent visual style (hidden line or shaded), for all views. Pat yourself on the back for a job well done. 😊
55. Save and close your file. Back up your project for safekeeping.



1 SW Perspective



3 SE Perspective



2 SW-Iso-Transparent



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No.	Description	Date

Green Inc.
Meadow Center
Perspectives

Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	Checker

A-1

Scale



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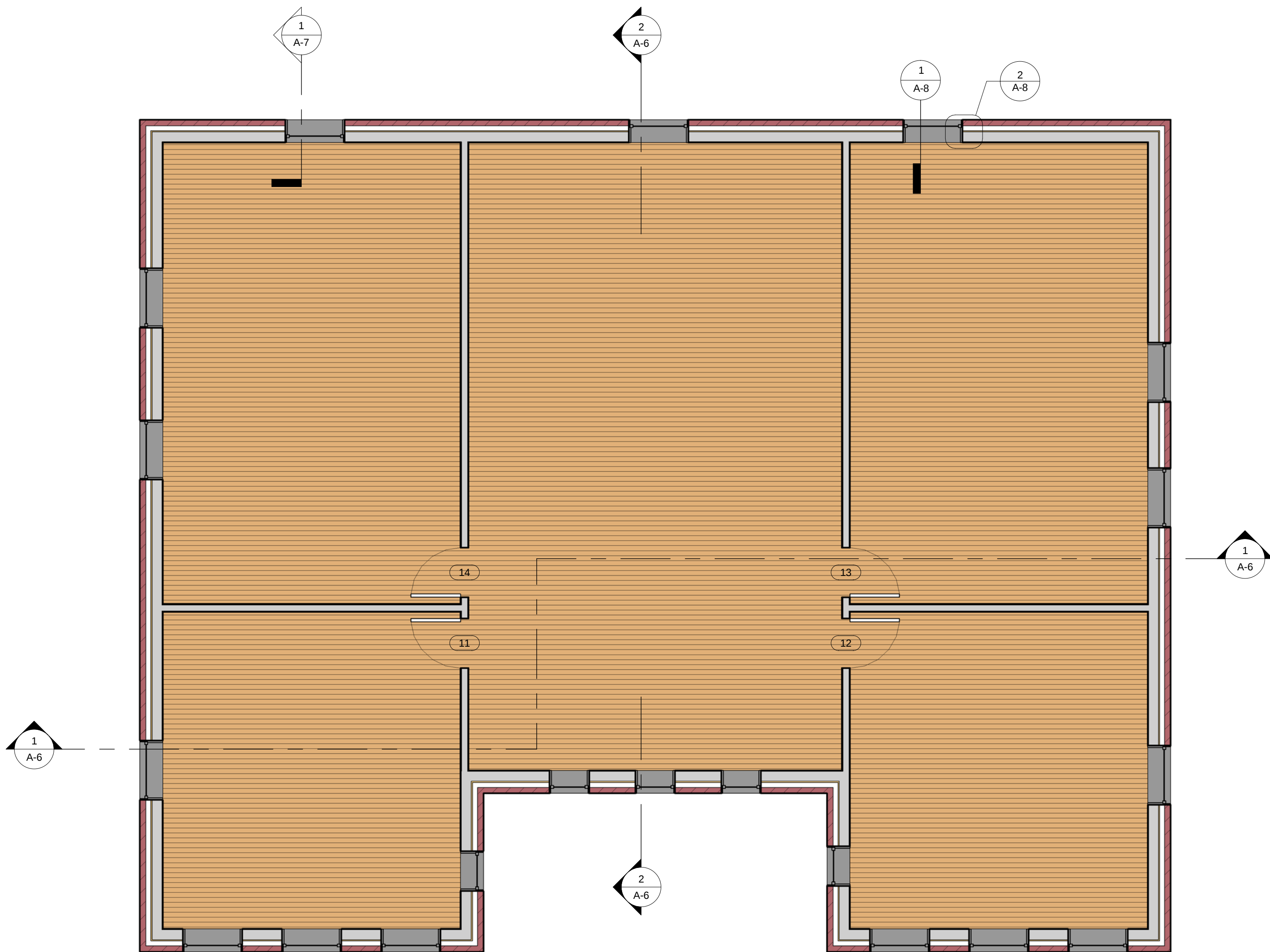
No.	Description	Date

Green Inc. Meadow Center First Floor Plan

Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	KB

A-2

Scale	1/4" = 1'-0"
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① Second Floor
1/4" = 1'-0"



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No.	Description	Date

Green Inc.
Meadow Center
Second Floor Plan

Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	KB

A-3

Scale	1/4" = 1'-0"
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No.	Description	Date

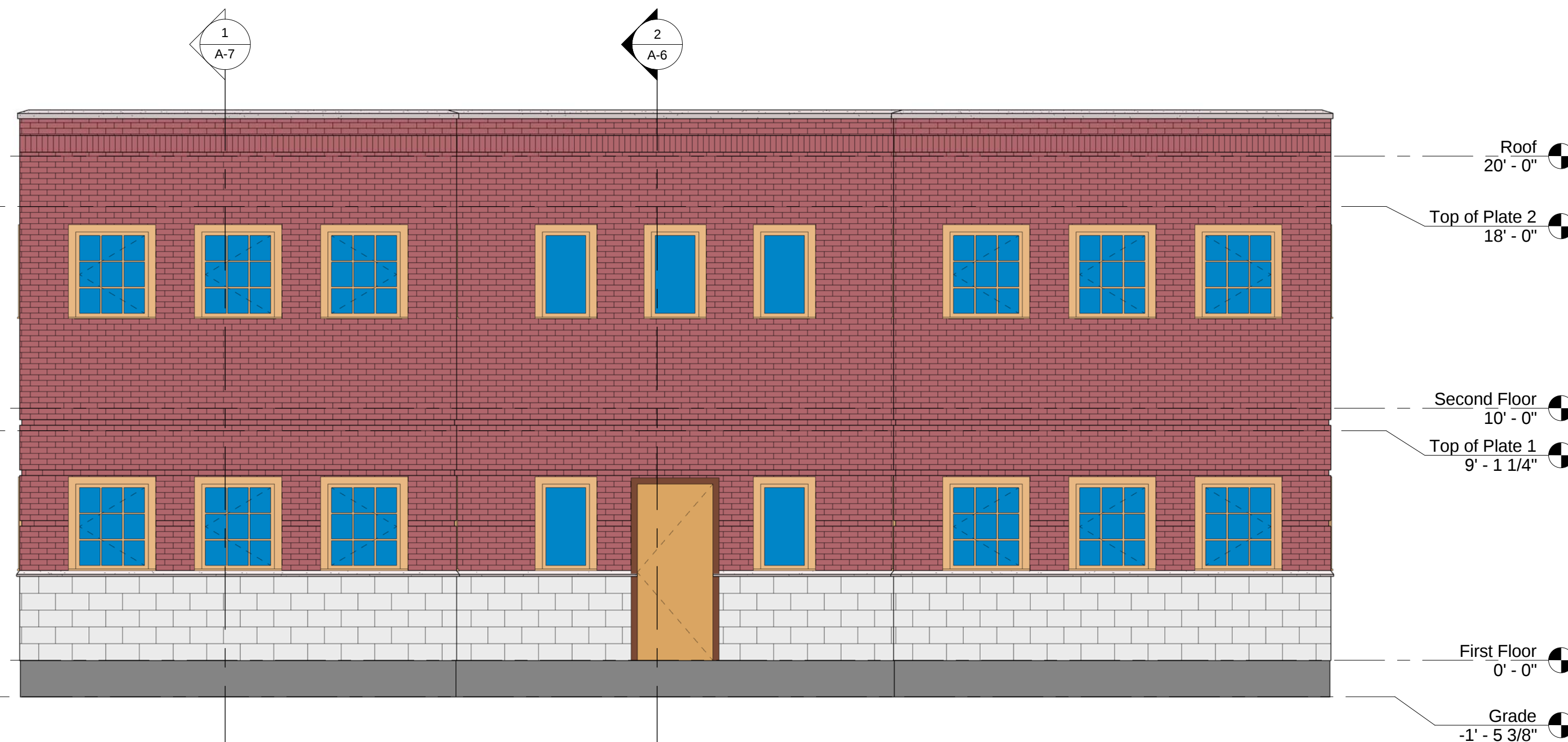
Green Inc.
Meadow Center
Elevations

Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	KB

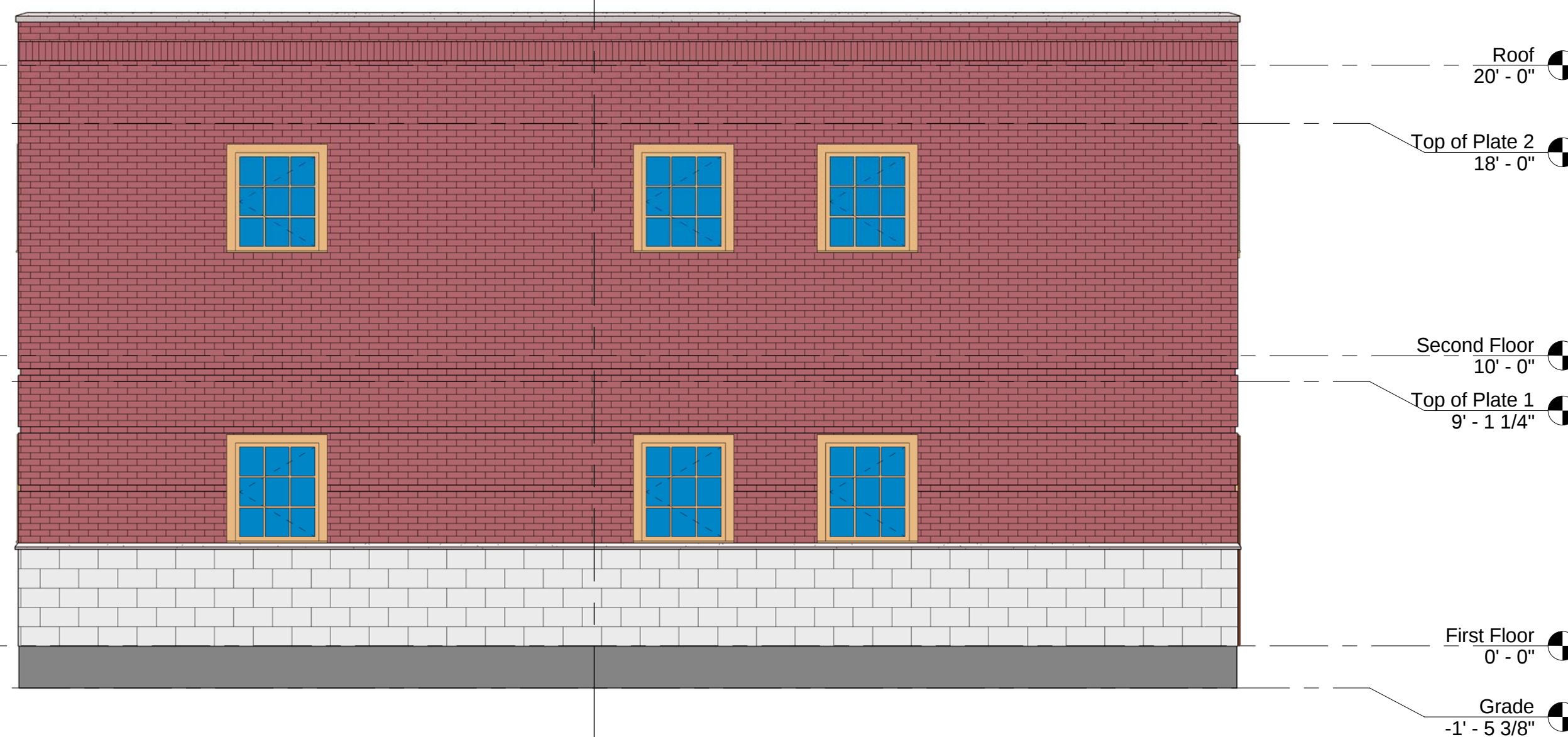
A-4

Scale	1/4" = 1'-0"
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① South Elevation
1/4" = 1'-0"



② East Elevation
1/4" = 1'-0"



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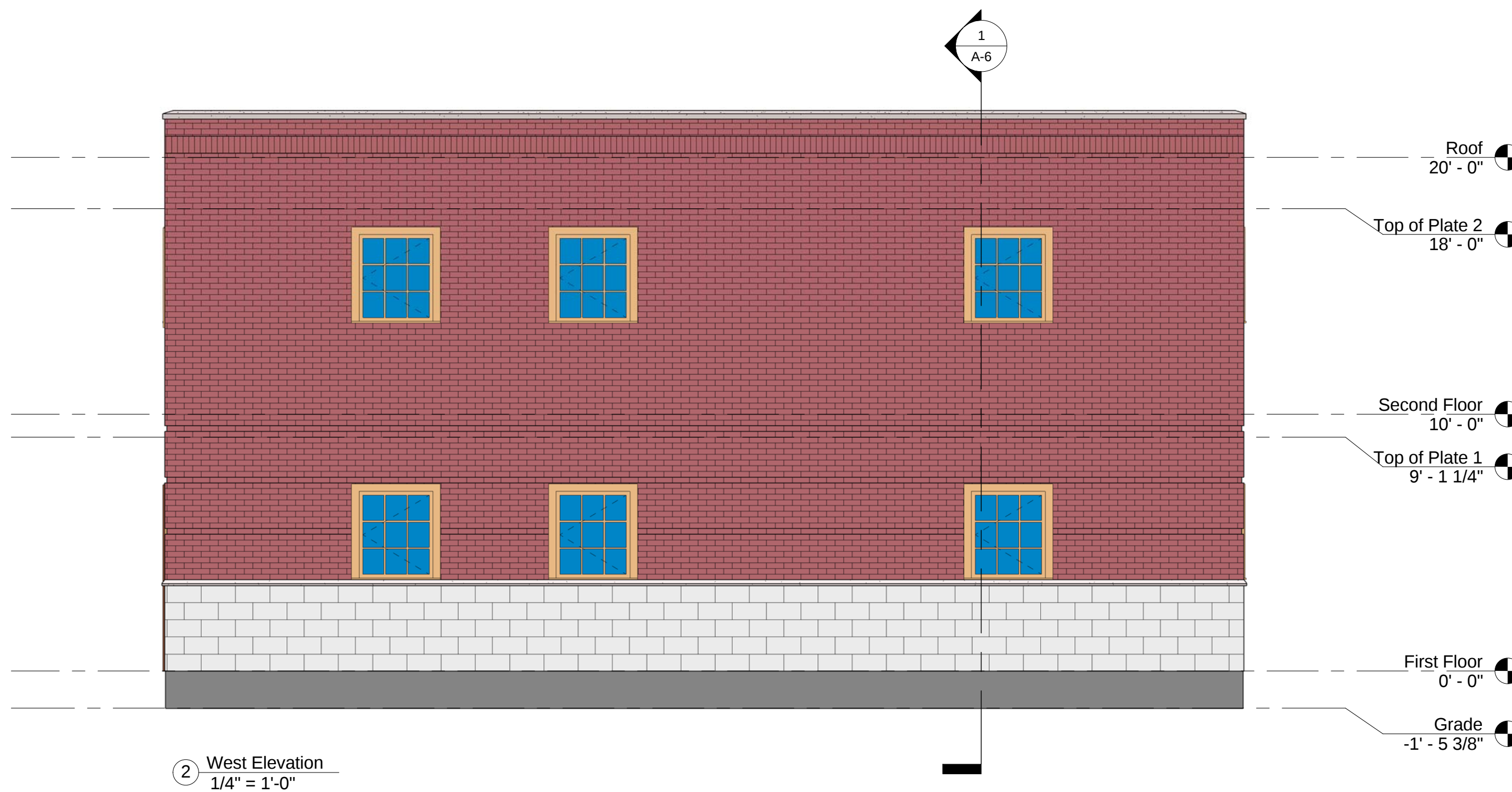
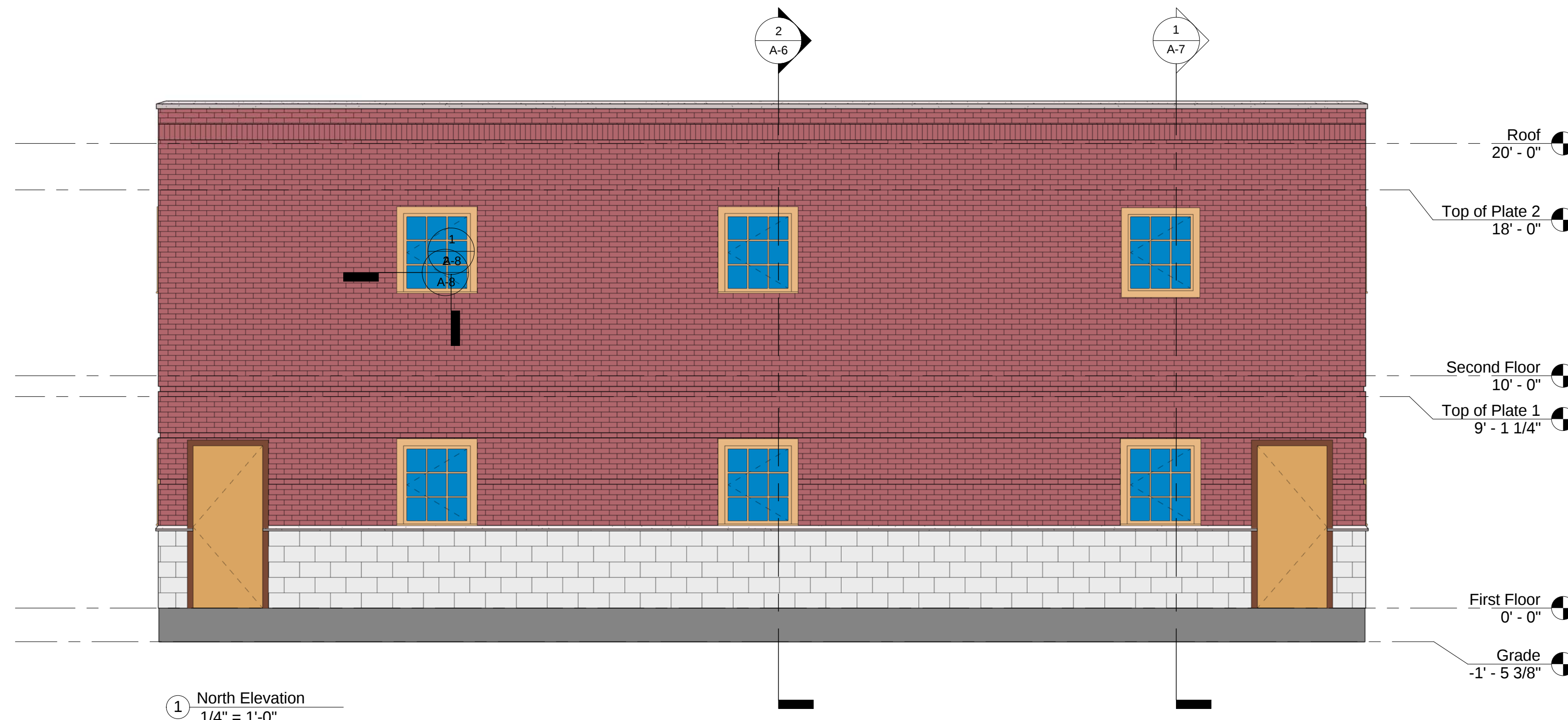
Green Inc.
Meadow Center
Elevations

Project number	2016-001
Date	Issue Date
Drawn by	Author
Checked by	Checker

A-5

Scale	1/4" = 1'-0"
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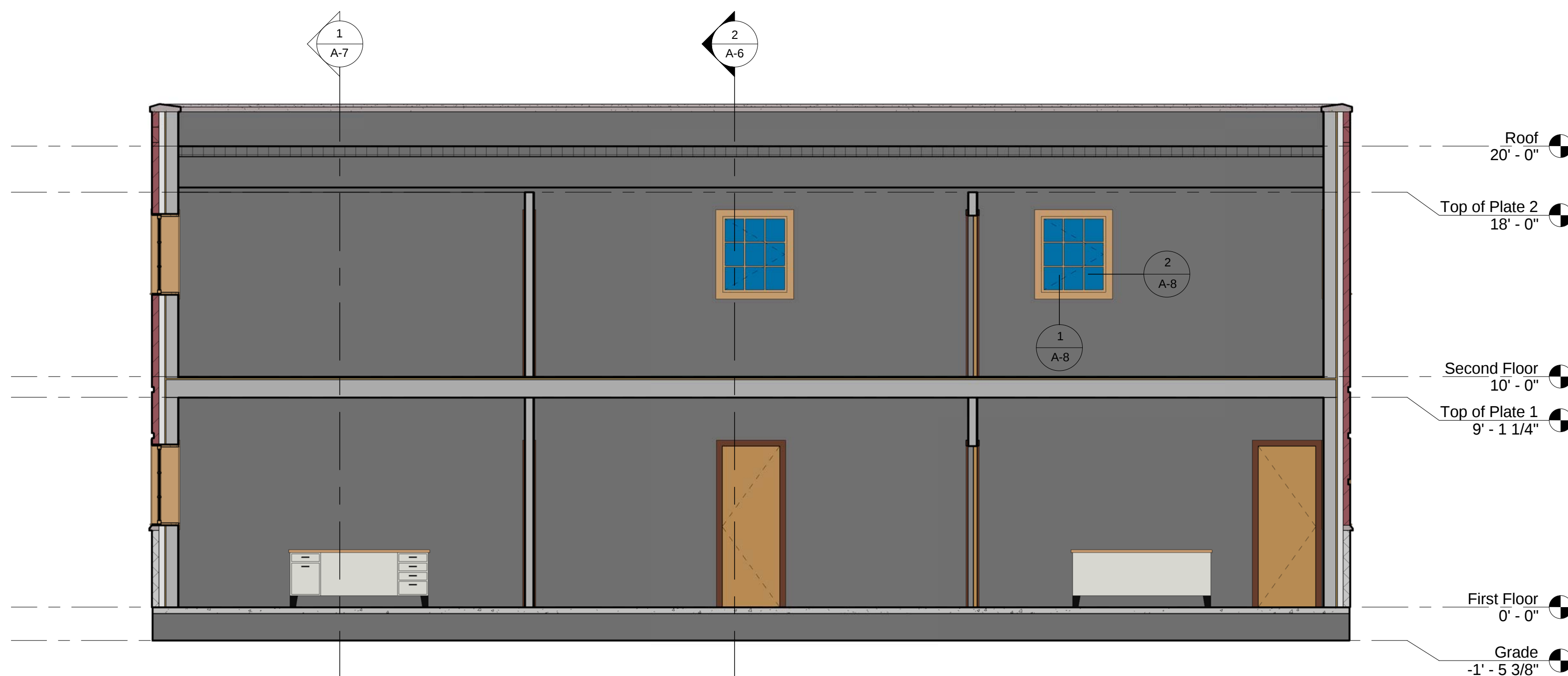
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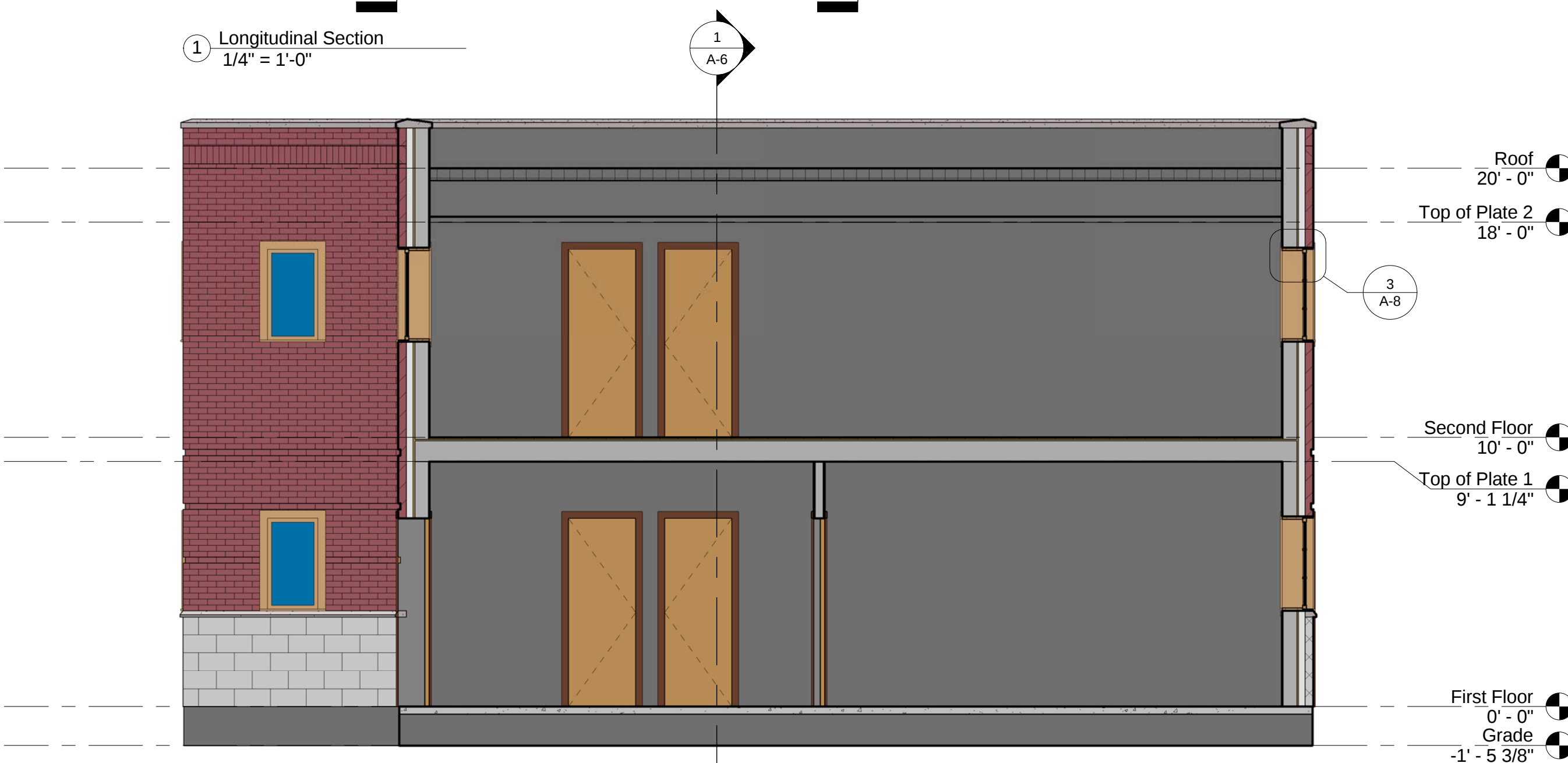
No.	Description	Date

Green Inc.	
Meadow Center	
Building Sections	
Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	KB
A-6	
Scale	1/4" = 1'-0"

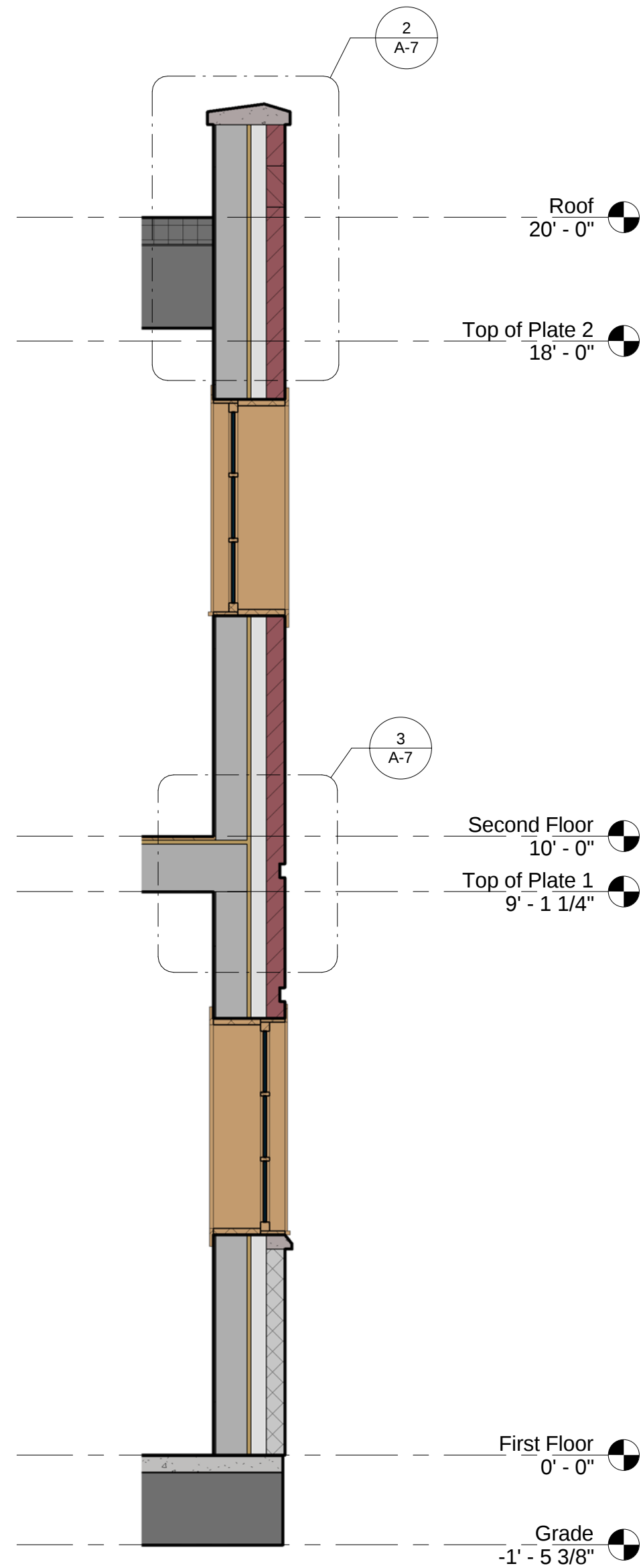
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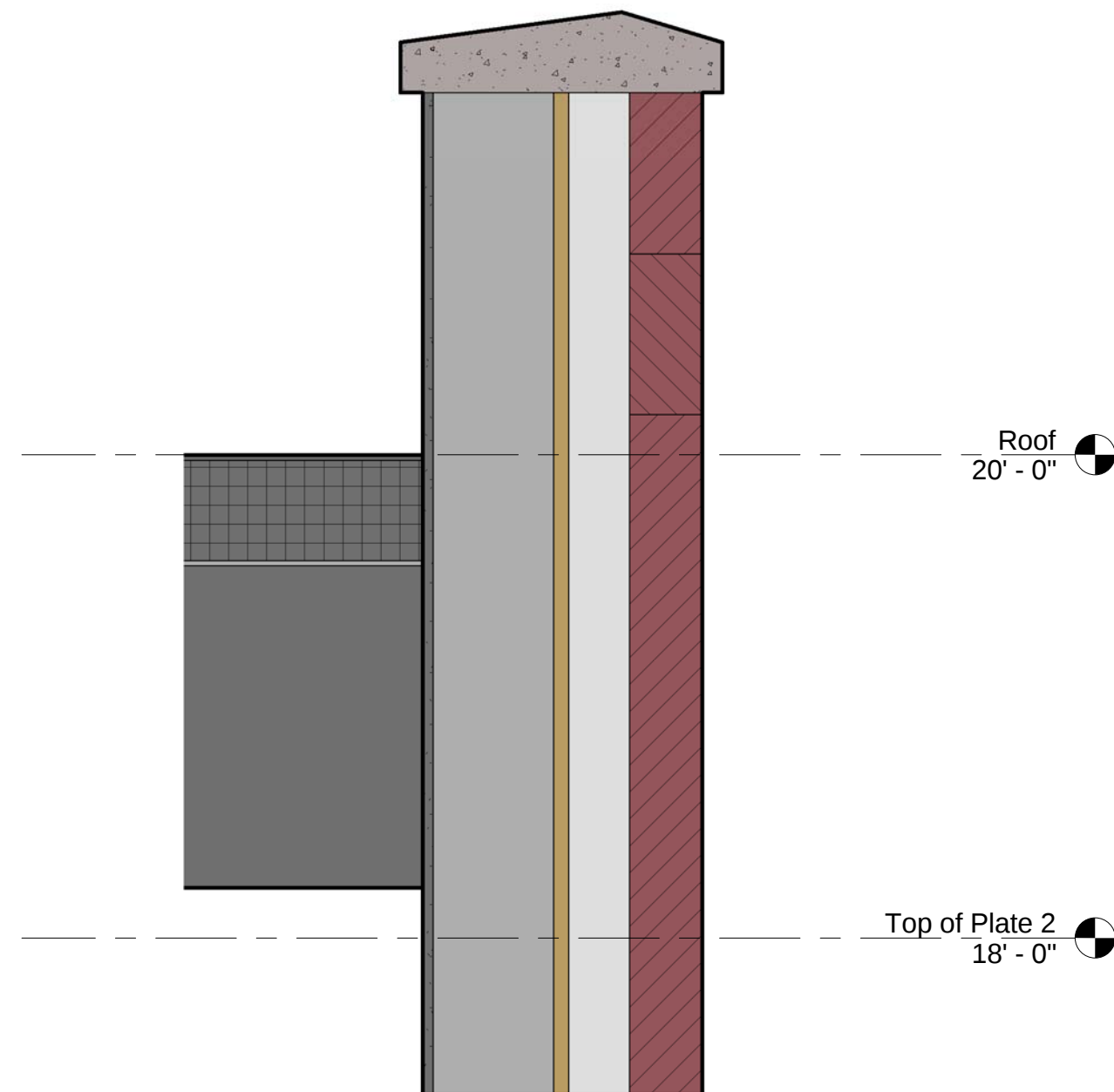
1 Longitudinal Section
1/4" = 1'-0"



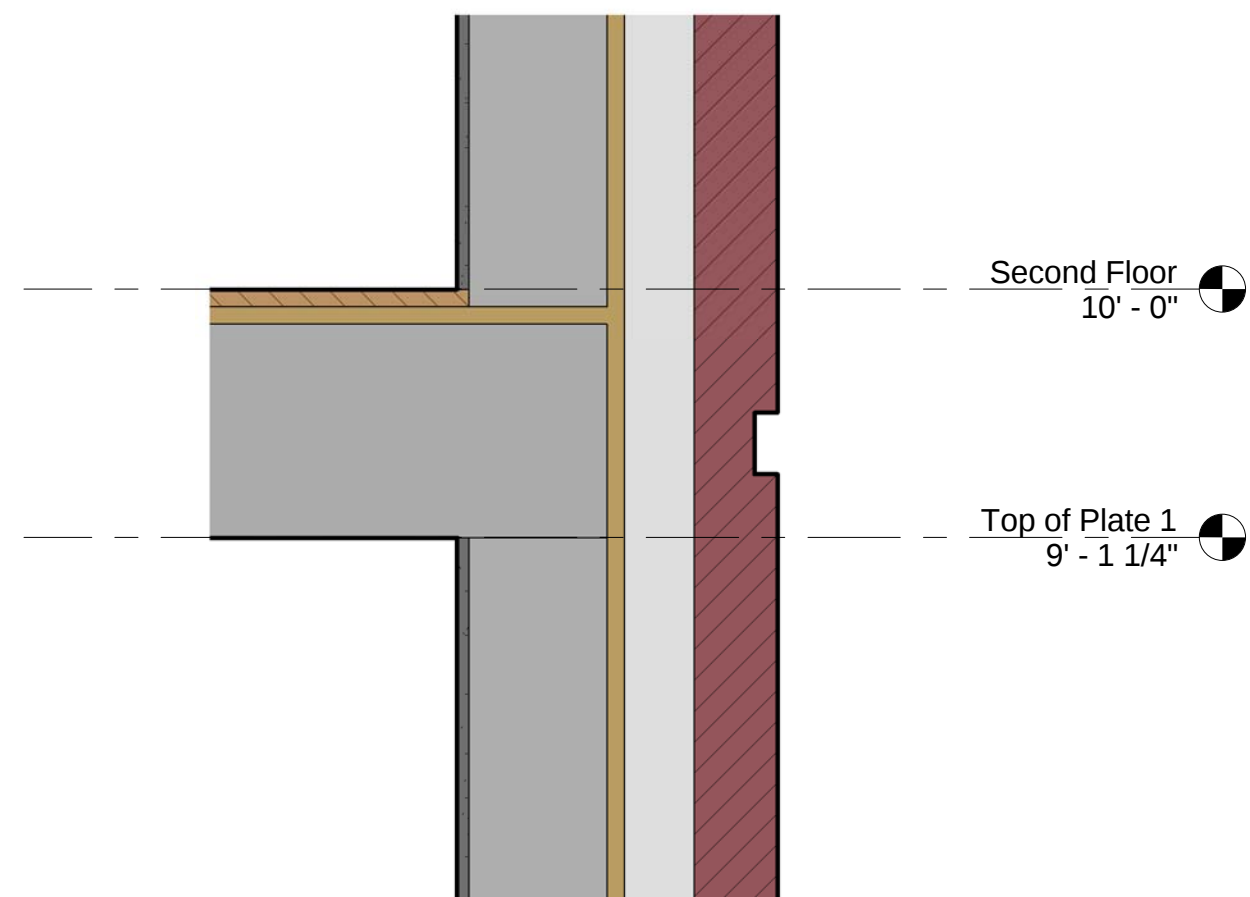
2 Cross Section
1/4" = 1'-0"



① Wall Section W1
1/2" = 1'-0"



② Section Thru Parapet Wall
1 1/2" = 1'-0"



③ Section Thru Floor at Wall
1 1/2" = 1'-0"



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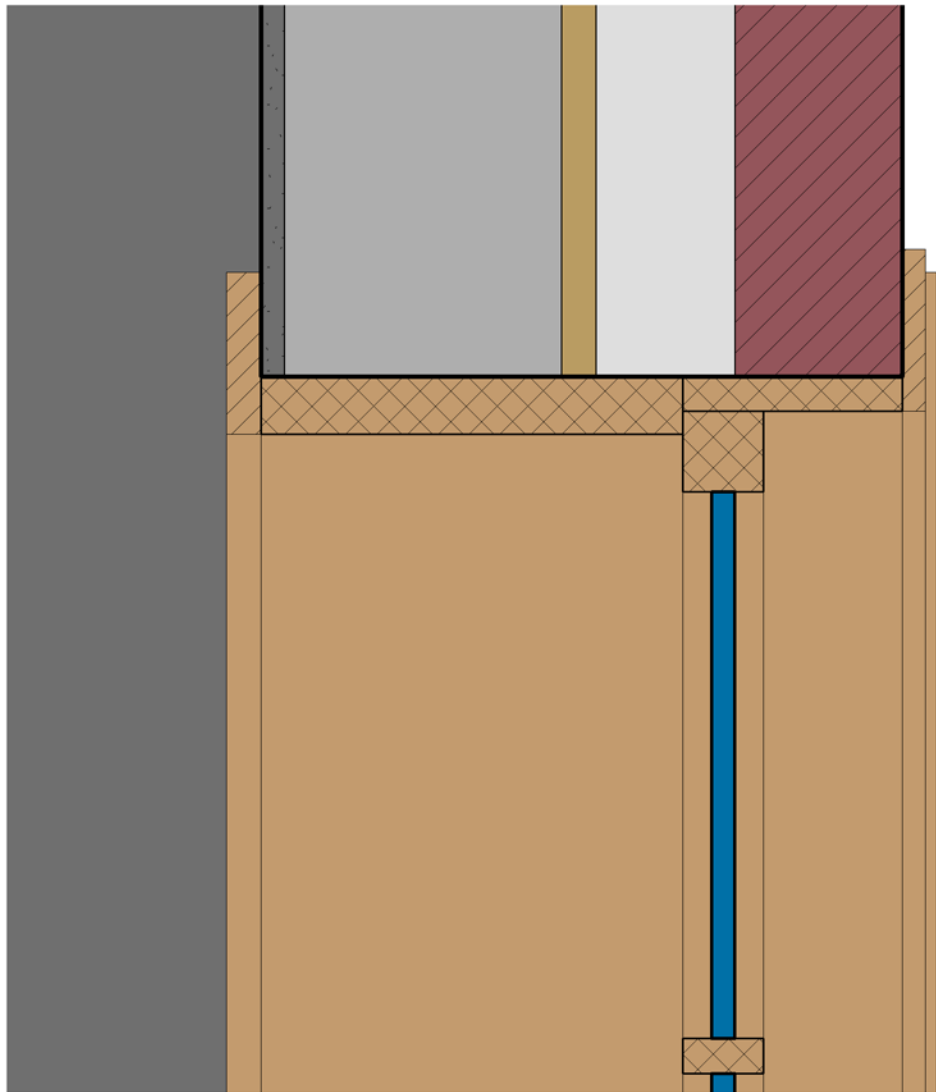
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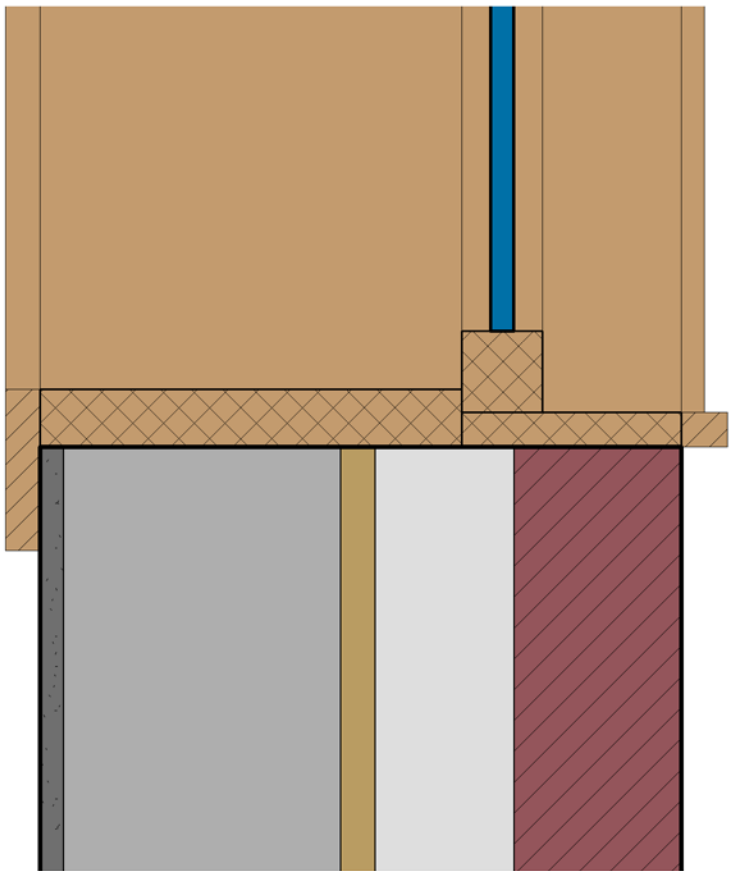
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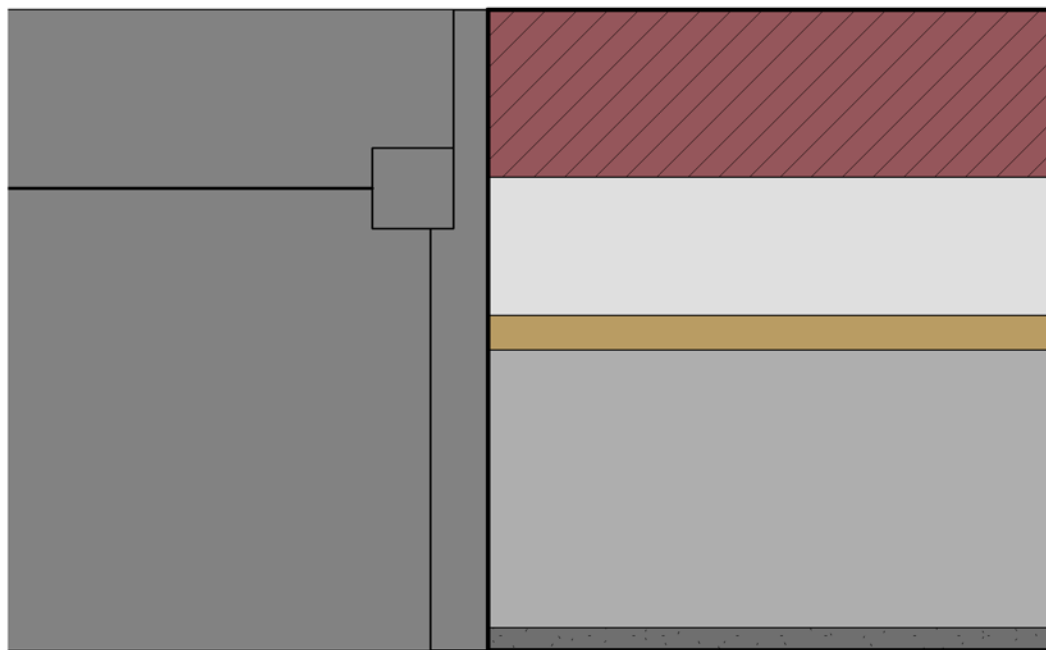
Green Inc.	
Meadow Center	
Wall Section and Details	
Project number	2016-001
Date	Issue Date
Drawn by	Author
Checked by	Checker
A-7	
Scale	As indicated



③ Window Head Section
3" = 1'-0"



① Window Sill Section
3" = 1'-0"



② Window Jamb Detail
3" = 1'-0"



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No.	Description	Date

Green Inc.
Meadow Center
Window Details

Project number	2016-001
Date	Issue Date
Drawn by	KB
Checked by	Checker

A-8

Scale	3" = 1'-0"
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AGENDA:

1. Project Settings and Custom Templates
2. Materials and Additional Settings

1. Project Settings and Custom Templates

Revit provides a huge array of options for fine-tuning and customizing the appearance and behavior of a project including: project units, annotation styles, fill patterns, line weights, view templates and more.

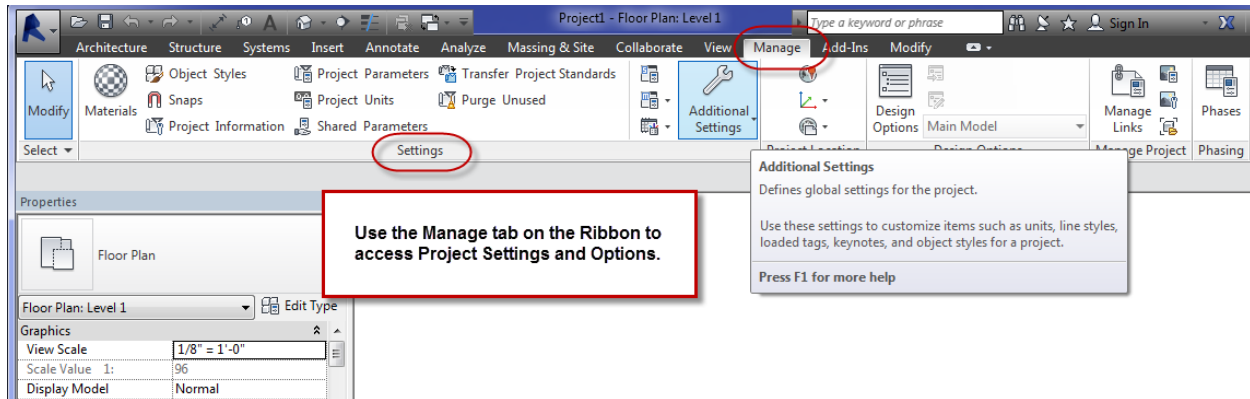
Project Templates provide all of the initial settings for a project and offer an excellent means of reusing information from one project to another. The information and settings that can be saved in a template include **Project Information** such as the organization name, project number, etc., **Project Settings** such as annotation styles and line styles, **Families** such as wall types, stair types, title blocks, etc., **Views** including levels, sections, cameras, etc., **Visibility /Graphic settings** including view-specific overrides, and **Print settings**.

More elaborate templates can include sheets and views which are already placed on those sheets. If you'd like you can even create a template that includes some pre-drawn geometry such as a few walls, a garage, and a typical exterior stair. You can then start a new project and begin to modify the existing geometry rather than drawing it from scratch.

Several Project templates are included with Revit but you can easily make your own template by saving a project with a template file extension, RTE. This option is always available when you have a project open and you use the Saveas command. In the Application Menu's Save flyout, just change Project files to Template files.

A custom Project template can be created by opening an existing template file, modifying settings as required and then use the Saveas command to select the Template file type and give the template a new name. You can start a blank project file with a bare minimum of information preset and then create and load as much information as required from scratch. You can then save the result as a template file.

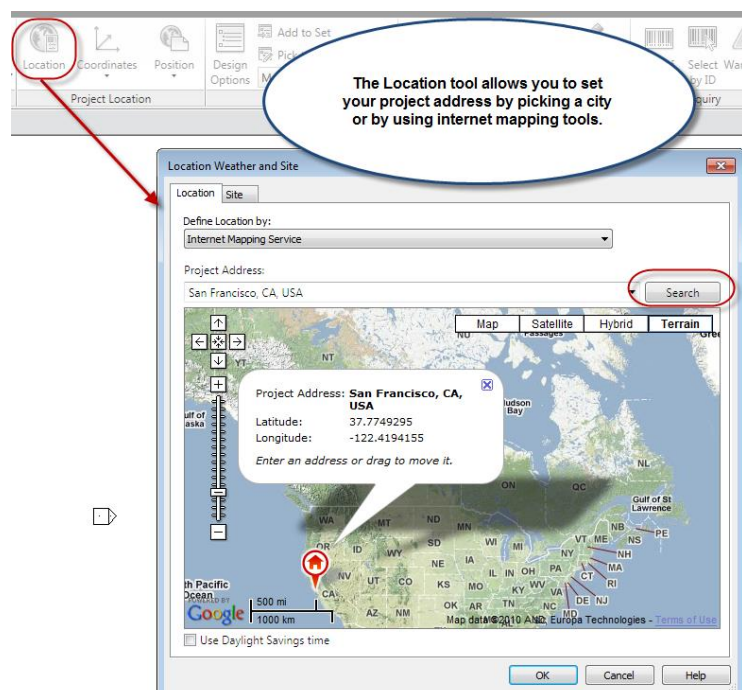
From the Manage tab on the Ribbon, it is possible to access almost all of the crucial options and controls which affect the appearance and behavior of elements within the Revit program.



The Settings panel is divided into three sections: Materials, Object Styles, Snaps, and Project Information are found at the left side, Other Project Settings including Project Units and Transfer Project Standards are in the middle, and Additional Settings provides a dropdown list of an array of other options at the right side.

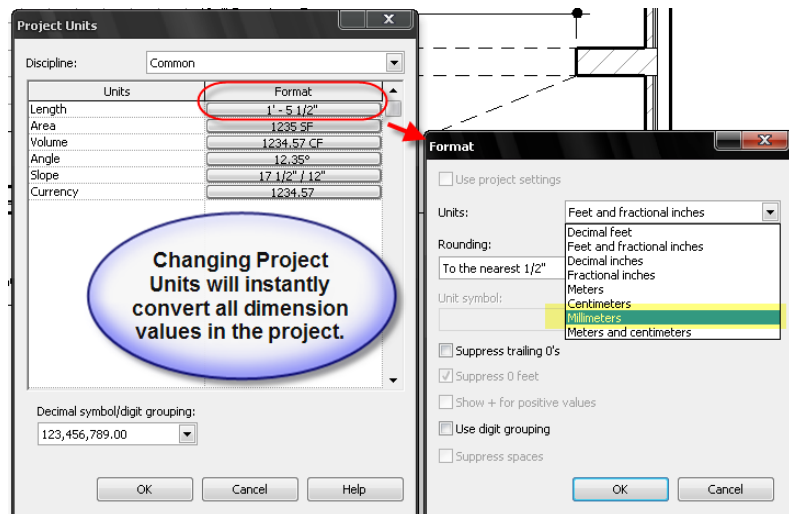
The Project Information Properties allows you to specify the common information which will appear on all of the sheets in the project. This data is saved in a System Family containing parameters for Project Dates, Name, Number, and Address.

The Project Location panel lets you set a geographic orientation with respect to Project North and True North. The Location for the project lets you choose a city or specify an exact set of latitude and longitude coordinates that will define where the project is placed in the World. This information is used to calculate sun angles for Solar and Shadow studies.



Project Units and Snap Settings

Project Unit settings let you control the appearance and formatting of all types of quantities. Here, it is possible to set rounding values and unit types and even switch between units of measurement, instantly converting all of the dimension values in your project from feet and inches to millimeters. (or vice versa)



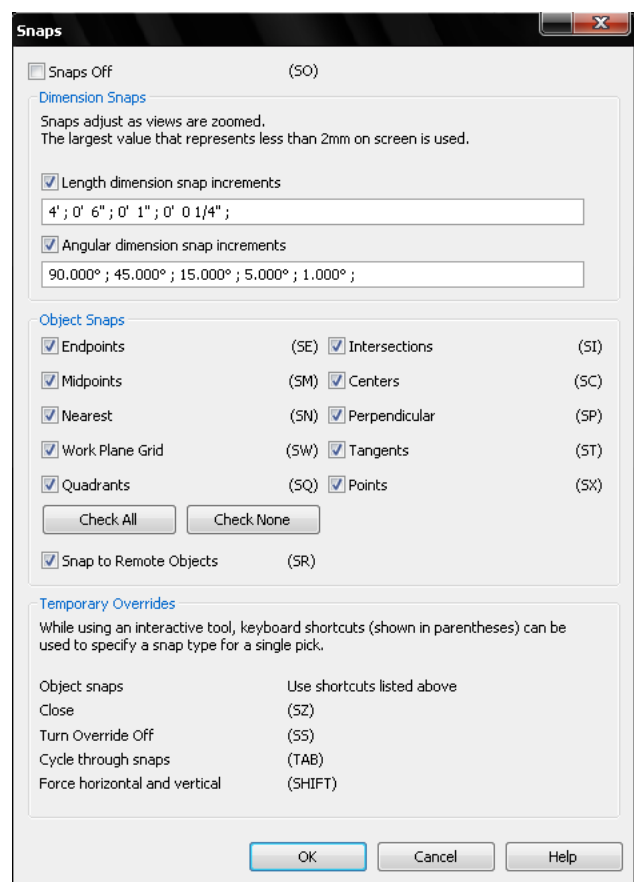
Snap Settings allow you to enable object snaps and set snap increments

Dimension snap increments are used whenever you place an element or move an element in your project. The size of the snap will vary depending on your current zoom level. As you get closer to the object, the snap distances will use smaller values.

Object snaps appear at critical locations on existing elements when sketching, placing elements, or moving objects.

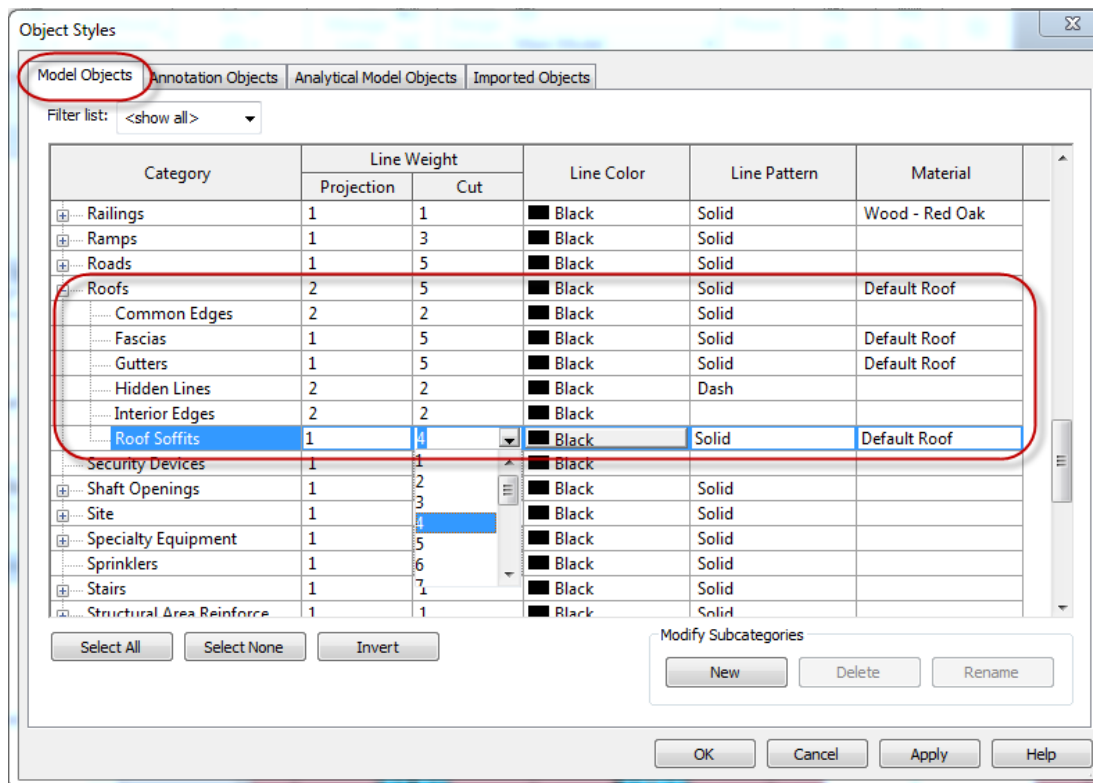
Snap lines are smart alignment features which appear automatically whenever two objects are close to lining up.

Use SZ to close a series of 3 or more segments. Use SHIFT key to force horizontal and vertical alignment for selected points.



Object Styles

Object Styles let you assign line weights, colors, line patterns, and materials to Model objects and imported objects in your project. Different line weights can be assigned to lines in elevation (Projection) and lines in section. (Cut). This allows us to cut a single object like a window frame in a plan view and have the cut frames use a nice heavy line, while the same elements in an elevation view are drawn with a thin line weight.

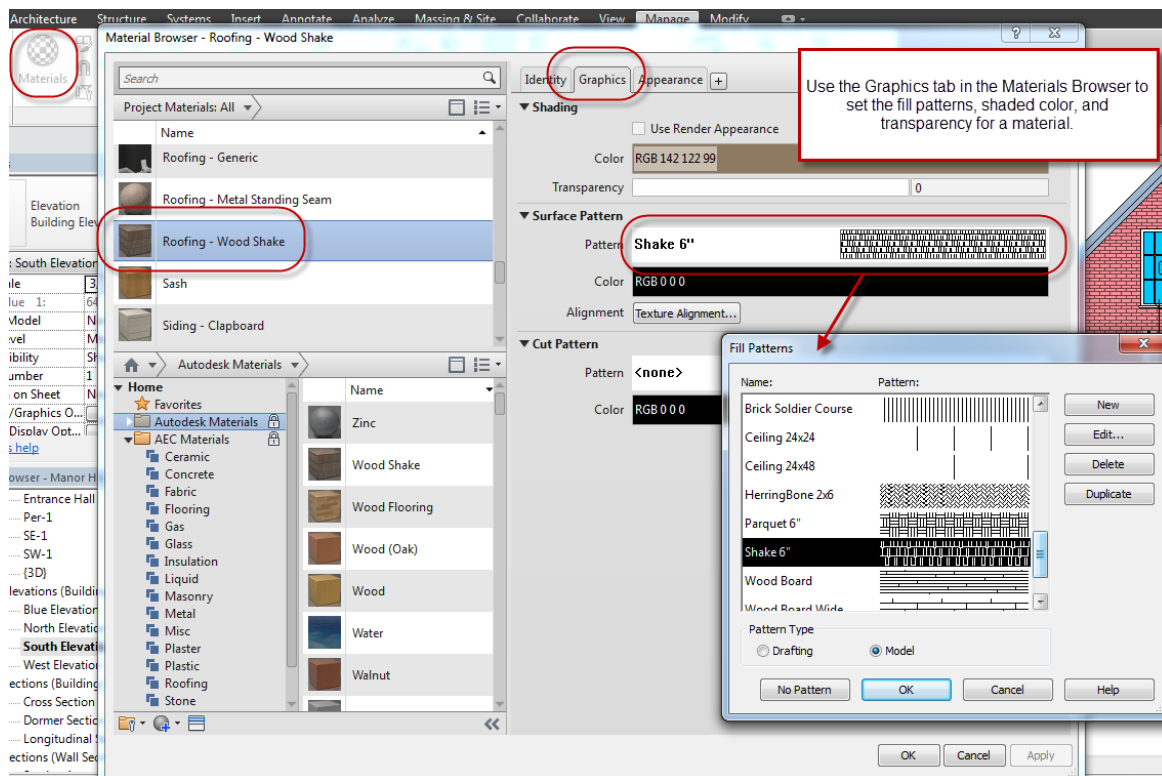


The Annotation Objects tab has one less setting than the model category as annotations always use the Projection type of line weight.

Expand the general categories to display available sub-categories. If you can't find the sub-category you need, perhaps for a custom family, use the New subcategory button to create as many as required and group them under existing top level categories. It is not possible to delete main categories or default subcategories, but custom subcategories can be renamed or deleted.

2. Materials and Additional Settings

Materials are used to define the appearance of all of the various elements that are in our building model. You can use the Materials dialog to find materials to assign to building elements, to modify existing materials appearing on the building, and to define new materials which can be used in the Project.



The Materials Browser can be accessed from the Settings panel or from within material assignment fields for many building elements. The left pane of the dialog lets you filter, organize, and display a list of materials while the right pane displays all of the settings for the currently selected material.

The materials browser lets you filter the list of displayed materials by selecting a Material class such as Fabric, Stucco, or Brick. You can also enter a name in the Search field at the top of the dialog which can be applied to all materials or just a selected class of materials.

Materials can be displayed as text, small thumbnails or large thumbnails.

Materials can define more than just the appearance of a model element in various views. In addition to the color, fill patterns, and transparency settings in the graphics tab, we can also define the rendered appearance settings, assign Identity data such as descriptions, product information, and keynotes. The Physical Tab even lets us define the material properties to use in strength calculations.

Materials are assigned to model elements initially using a category or sub-category in the Object Styles settings. Materials may also be defined in a Family as type parameters or even as instance parameters. In both cases you would be able to see and access the material assignment in the family editor or through the element properties dialog.

If a material is assigned in a family as a type or instance parameter, this material would override the material assigned to that category or sub-category in the Object Styles. If there is no material assigned in the family, the element will use the default defined in Object Styles. Materials may also be assigned to a selected face of a model element by using the Paint tool. This method of explicit face materials will override any other method of material assignment including category settings, type parameters and instance parameters.

To change the model appearance for a material, select that material in the Material browser and open the Graphics tab. In the Shading section choose the color swatch to open a color selector dialog or if appropriate, select the *“Use Render Appearance for Shading”*. If the material is transparent, set a transparency percentage where 0 is perfectly opaque and 100 is perfectly transparent. The Surface pattern section lets you choose a model fill pattern to display in elevation and 3D views while the Cut pattern lets you choose a drafting fill pattern to apply to the object when it is being cut in a plan or section view. Use the color swatches if desired to assign a color other than the default black to use for the patterns.

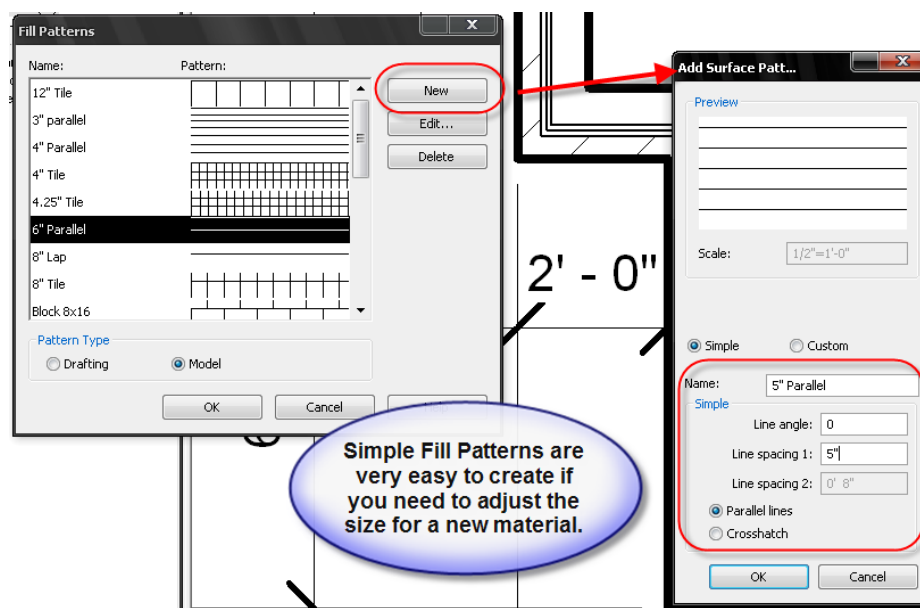
New materials are created by duplicating an existing material in the same class, assigning a name for the new material, and then modifying the properties as required. You can also create a new material from scratch and then define all relevant properties by importing Assets from the Asset Browser.

Materials are stored as part of a project file. You can share materials between projects by using the Transfer Project Standards on the File menu.

Fill Patterns

Fill Patterns allow us to add hatching to surfaces in both sectioned and elevation views to help indicate the material for an element. Revit uses two types of fill patterns: Model Patterns and Drafting Patterns.

Model patterns are used to represent real elements on your building and include things like roof tiles, brick pavers or floor tiles. If you look at a brick wall in a view set to a scale of 1:50, the bricks will look very small, but when you set the scale to 1:10, the size of the bricks, relative to the Sheet on which the view is placed will get much larger. This is the nature of a model pattern. It always stays the same fixed size relative to real world coordinates and will change size only when depicted on a sheet at different scales.

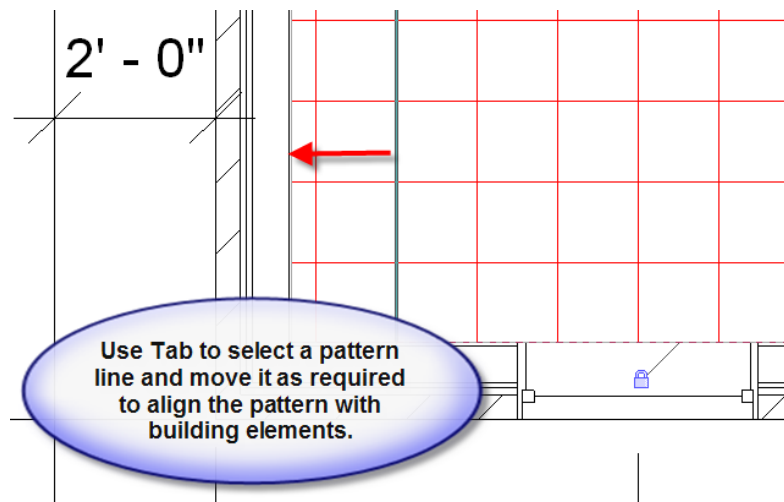


Drafting patterns are symbolic representations of materials and are usually depicted at approximately the same size relative to a drawing sheet. These patterns are used more in section views such as showing a diagonal line for hatching concrete blocks or using mix of triangles and dots to represent poured concrete. A stipple pattern is also used to represent stucco or plaster in elevation views. These types of patterns are always drawn at roughly the same spacing between elements regardless of the scale of the view.

New Fill Patterns may be created by specifying a name, line spacing and line angle for one or two sets of lines. Patterns may be defined as single or double-hatched with the Parallel and Cross Hatch options.

Complex patterns may be defined by choosing the Custom option and importing a Revit pattern file with a .pat extension. Pattern files may be found online or may be created manually by specifying the coordinates and angles to draw the elements in the pattern.

Model hatch patterns may be moved, rotated, dimensioned and aligned to aid in the correct placement and orientation of the pattern.



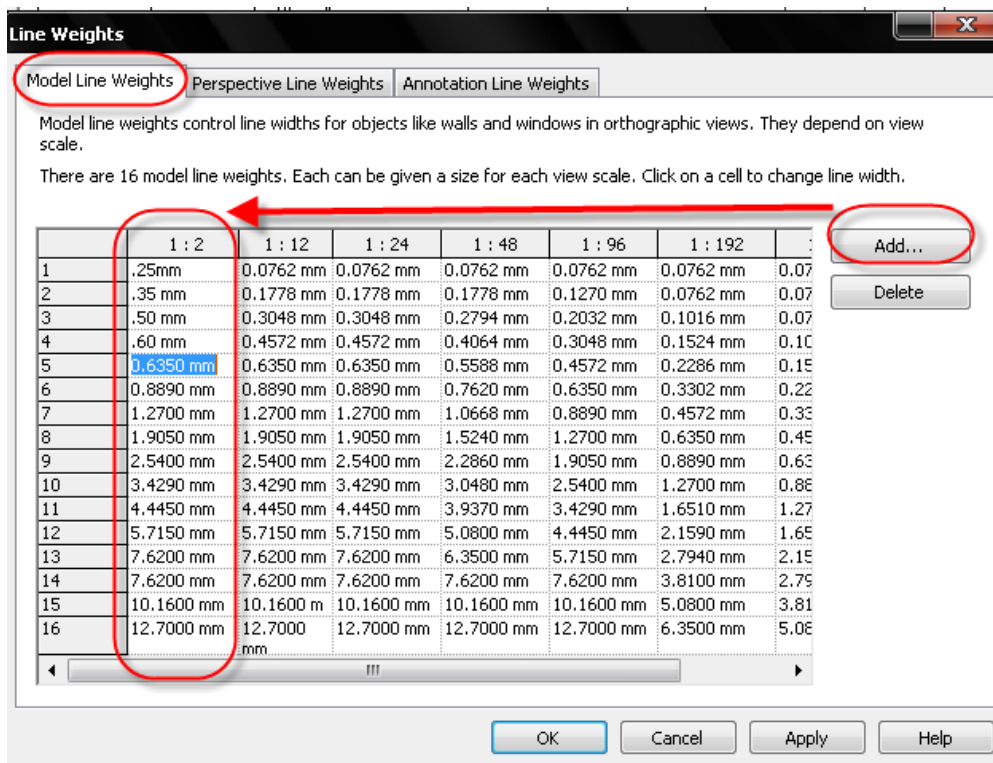
To move a Model pattern, highlight or select the element displaying the pattern and then press Tab to display the closest pattern shape handle and then pick it. You can drag the pattern line or if you use the Move tool you can specify a distance or snap to points.

To quickly move a pattern element to an existing edge, use the Align tool, pick the building edge, and then select the pattern handle. Lock the alignment if desired.

Adding dimensions is a great way to centre a tile pattern in a floor. If you have a 2" strip of tile at one edge of a 12" tile floor, the floor would look better with a 10" strip of tile on each edge. Add a dimension between the edge of the tile and the edge of the wall, pick the floor, set the dimension value to 10" and it will be perfect.

Line Weights

Line weights may be specified for model lines, perspective lines and the lines used in annotations such as dimension or section lines. A line weight, in Revit, is not an explicit width but rather a generic number from 1 to 16 with the higher numbers using wider pen widths. Perspective and Annotation categories use a single line width for each of the 16 line weights.



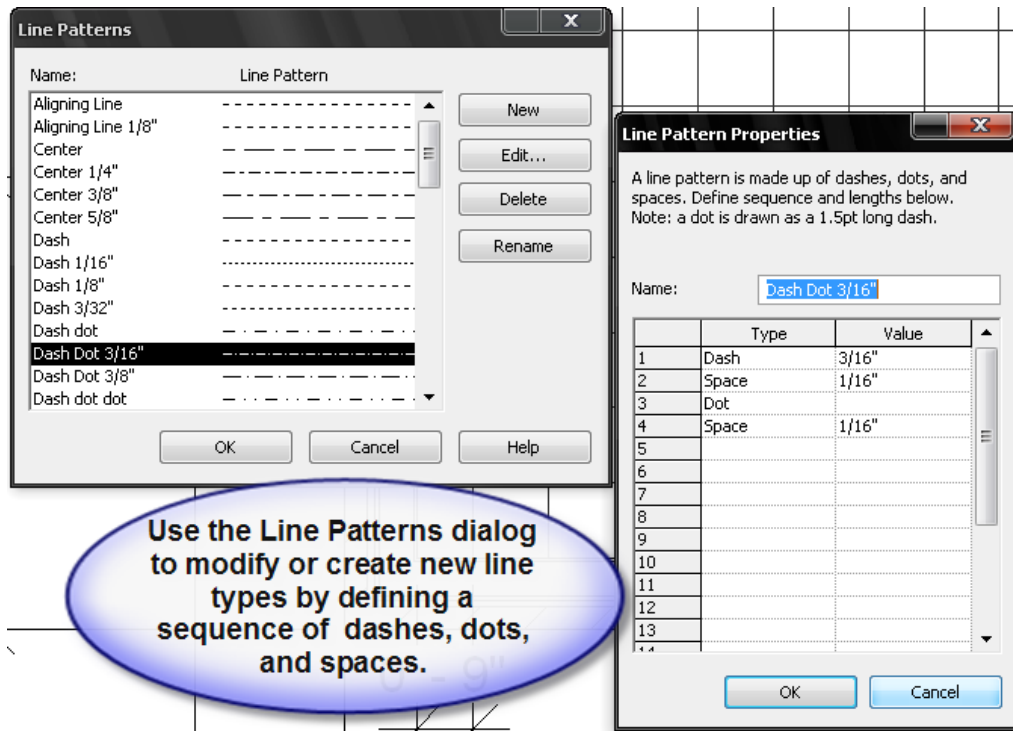
In the Model category however, each of the 16 line weights can vary according to the selected scale.

This is a very clever way of assigning line weights as an object can be depicted with heavier lines automatically as the scale changes. For example a window frame being cut might use a line weight of 4. In a view with the scale set to 1:100, the line width might be .25mm, but at 1:50 the same edge would draw with a .35mm pen and at a scale of 1:10 could be set to draw with a .50mm line width.

It is unlikely you will need to change the line weight settings in Revit as they are designed to work well with the majority of architectural elements. To create a heavier set of lines for larger scale details, use the Add button to create the new scale.

Line Patterns

Line Patterns are another means of conveying information in a drawing. Comprised of a series of dashes, dots, and spaces, with defined sizes, they indicate the location of edges above or below the current level, border line locations, and even the appearance of elements in alternate positions.



Revit includes a wide range of line patterns that are setup to work well in most cases but if you do need to modify the size of a non-continuous line type, use the Edit or New button in the Line Pattern dialog box and you will be able to specify the exact dimensions for all elements within the line pattern.

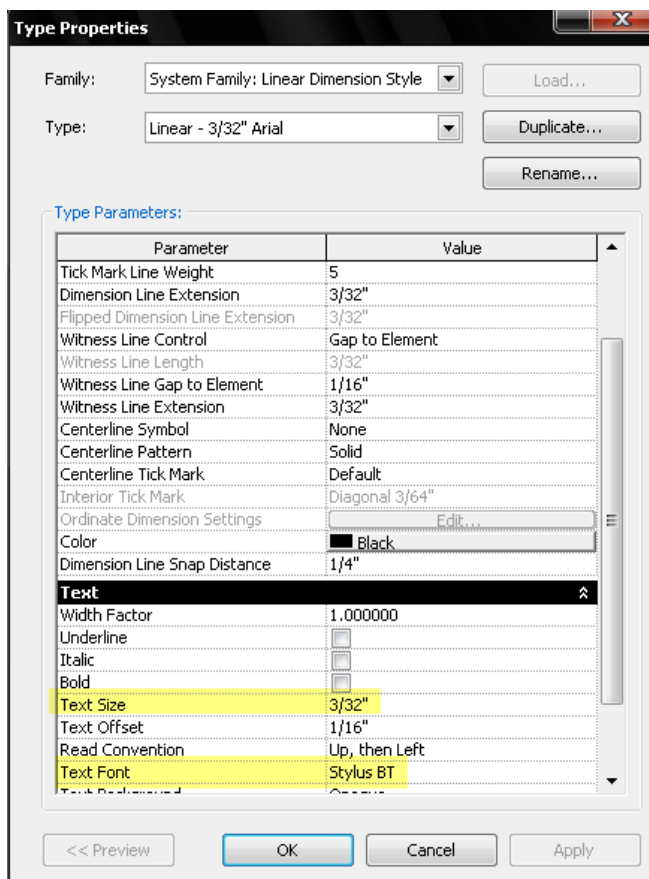
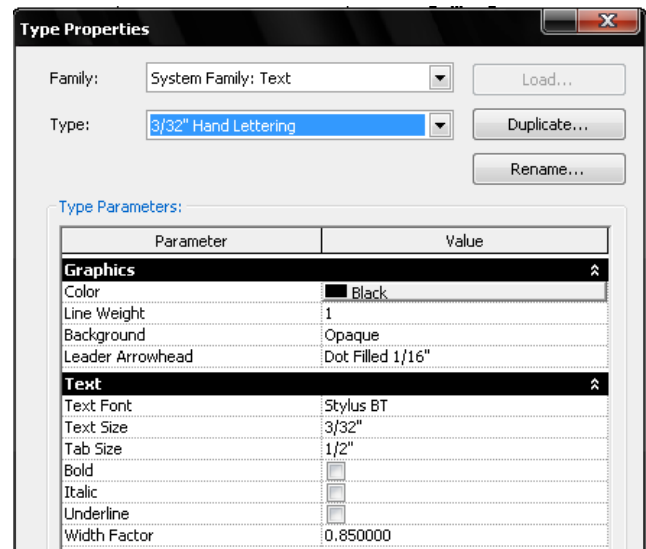
Dots in line patterns are predefined at a certain length and do not require any dimension in the line pattern properties.

The Line Styles dialog allows you to group a set of line properties such as line pattern, line weight, as well as line color and group them with a name such as Medium lines, Thin lines, Wide lines, Hidden lines, etc. The line styles panel appears on the Ribbon whenever you start drawing lines.

Annotation Styles

Annotation Styles allow you to control the appearance of notes, dimension settings and arrowhead styles. In Revit, when you create or modify what you think of as a Style, you are actually modifying a Type in a System Family and it uses a similar dialog to the type properties for a window or a floor.

Annotations, such as notes and leaders will use a Text family type. You can modify the settings of the existing types or create new, custom types with a wide range of options that can be saved in the Type.



An Arrowhead style includes choices for dots, ticks, angled arrows, boxes, etc. and lets you set the size and fill options. After saving the arrowhead style as a new type, you can access it for use with leaders or dimension types.

Dimension types are available for linear, angular, radial, and spot variations. The type parameters include a huge array of settings you can use to fine tune the appearance of your dimensions.

To modify Type Properties or create new types for any type of annotation, start the annotation command and then choose Edit Type from the Properties Palette.

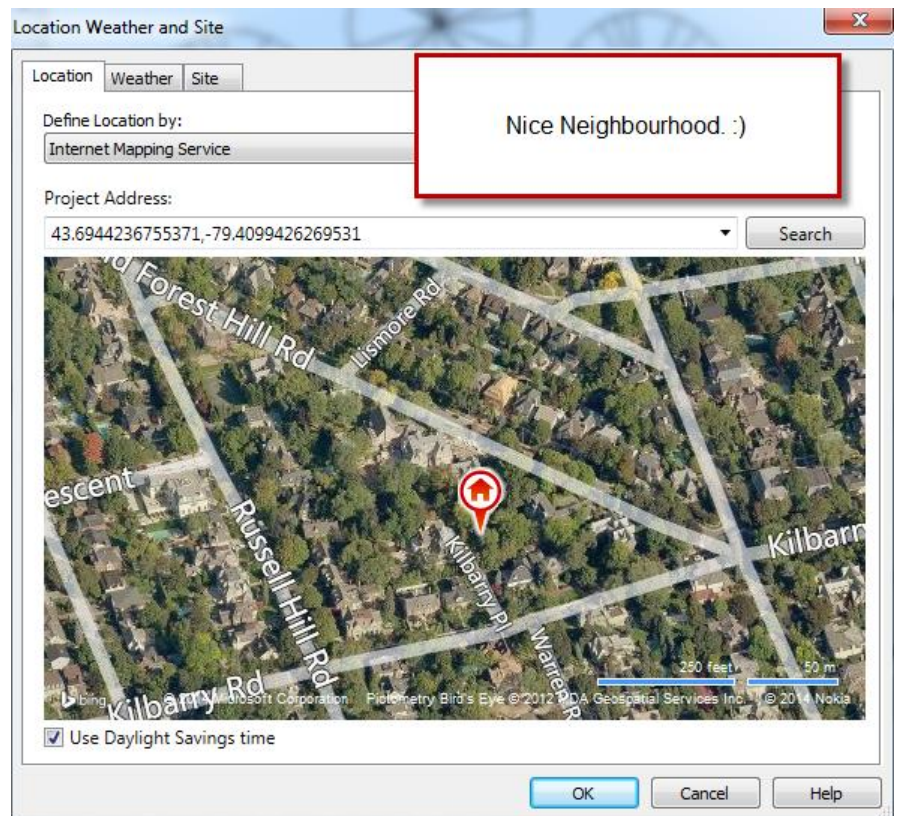
Exercise Notes

In the following exercise you will start a new project with the Default template, modify the project settings, load a few families, create a few levels and then save a new template file. When this is complete you will, save a new project, and begin to layout the building envelope for your final project, Manor House.

3. Start a new project with the default Imperial template. From the Manage tab of the Ribbon, choose Project Information on the Settings panel. Set the following information:

- Issue date- Enter current date
- Project Status - Design
- Client Name - Green Inc.
- Project Name - Manor House
- Project Number - 2015_001

4. From the Project Location panel on the Manage tab, choose Location. In the Location tab, type Toronto in the Project Address field and pick the Search button. Type Kilbarry Pl. in front of the word Toronto and pick Search again. Look in the City pulldown window and find Toronto, ON, Canada. Experiment with the Map options and adjust the zoom level until you can find the empty backyard shown at right. Looks like a nice spot to squeeze in a new house! lol



5. From the Additional Settings pulldown on the Manage tab, choose Fill Patterns. With the Pattern Type set to Model, pick New and define a new, Simple pattern with a line angle of zero, a line spacing of 5", and the Parallel lines option selected. Name the new pattern, 5" Parallel. Pick Ok twice.
6. From the Settings panel on the Manage tab, choose Materials. Set the Material Class to Wood. Pick the Oak Flooring Material and pick the Duplicate Selected Material button in the lower left corner above Properties. Name the new material Wood – Flooring – Wide.
7. With the material selected, in the Graphics tab, Select the color swatch and set a new color. Try RGB values around 200, 110, 55. In the Surface pattern pulldown, select the new 5" Parallel fill pattern you created in the previous step. In the Cut Pattern pulldown, select the Wood 1 pattern. Pick Apply.
8. A material can be defined with three types of Assets – Appearance, Physical, and Thermal. Switch to the Appearance tab and review the material settings. Review the Physical and Thermal Asset tabs and the settings that go into describing this material. Note the big X in the upper corner of the Physical and Thermal assets which allows you to remove these assets if they are not required.
9. Switch back to the Appearance tab and choose the Replace Asset button to open the Asset Browser. Expand the category for Autodesk Physical Assets and Select Wood. View the available wood types defined in this folder. Check the Flooring Category This library has a few Appearance assets but is more important for the Physical and Thermal assets.
10. Expand the Appearance Library heading and select Wood. Review the available materials. These are wood grain materials for furniture. Switch the Flooring category and then the wood subcategory. Review the available wood floors, pick your favourite, and then double-click it to add it to the wood flooring material definition. Close the Asset Browser.
11. Edit the values in the information fields for name and description to Hickory Plank – Cherry Stain. Pick the image swatch for the material to open the texture editor. Change the width value from 3'-0" to 6'-0" to reflect our selection of a wide plank flooring style. Pick Ok and then Ok again to close the material browser.
12. Create a simple, rectangular floor using the default floor type. From the Build panel on the Home tab, pick Floor. Use the lines tool to create a rectangle and then pick Finish Sketch. Type SD to Shade the view.

13. From the Settings menu, choose Object styles. In the Model Objects tab, find the Floors Category and in the Material column, pick Default Floors and then choose the Browser button to open the materials dialog. Set the material class to Wood and select the Wood Flooring Wide material you created in step 4. Pick OK. Pick OK again.
14. Select the floor and in the type selector, change the floor type to the Wood Finish 10" floor type to compare it to your wide plank flooring. Delete the sample floor you created to test your new material.
15. From the Additional Settings dropdown, choose Arrowheads. Duplicate the Diagonal 1/8" arrowhead and create a new type called Diagonal 3/32" with the tick size set to 3/32".
16. From the Quick Access toolbar, choose the aligned dimension tool. On the properties palette, choose Edit Type. Choose Rename and set the name to Linear – 3/32" Stylus. Set Tick Mark to Diagonal 3/32" and in the Text Font section, pick and then type in Sty to select the Stylus BT text font. Set the text height to 3/32" and make it Bold. Set the width factor to .85. Pick Ok.
17. Modify the Angular dimension type as well, renaming the type to Angular Stylus. Set it to use the Angle 90 arrow type, stylus font, and a text height of 3/32". Pick Apply and Ok to close the dialog.
18. From the Annotation tab, pick the diagonal arrow in the lower right corner of the Text panel to open the Text family Type Properties dialog. Duplicate the current type and create a new Annotation text type called 3/32" Stylus. Set the leader arrowhead to Dot Filled 1/16".
19. Add a couple of test walls using a generic 6" wall type. Add an angular dimension between two non-parallel walls and also add a linear dimension showing the width of a single wall.
20. From the Settings panel on the Manage tab, choose Project Units or type UN. Select the format button by Length and choose the suppress 0 feet option. Under Rounding, select "to the nearest 1/2". In the Angle format section choose the Suppress trailing 0's option. Pick Ok twice to close the dialogs and examine the dimensions to see how they have changed. The unit format in the Dimension types is currently set to follow the default Project units. Delete the walls and dimensions.
21. Let's load a few components that we'll need in a typical residential project. From the Insert tab on the Ribbon, choose Load Family. In the Openings Folder, load the Passage Opening-Cased, and the Passage Opening-Elliptical Arch.

22. Open the Load Family dialog again and browse to the Doors category. Select the Single flush and Double flush panel doors and pick Open. Load the types for 30" x 84" and 36" x 84" doors for the single family and 5'-8" x 84" for the double family.
23. Browse to the Doors/ Residential folder. Review the available door families but do not load too many now. We will save a couple of generic families with our template and then we can come back and load more complex families in the actual project file. For now, choose the panel overhead garage door and load it into the file.
24. Continue to Load families. In the Base Cabinets category of the Casework folder, load the the Base Cabinet-Double Door Sink Unit families. Load a countertop with round sink hole.
25. In the Plumbing / Architectural / Fixtures folders, load the Sink Vanity-Round, Toilet-Domestic-3D, Tub-FreeStanding-3D, and Tub-Rectangular-3D.
26. In the Specialty Equipment folder, browse the Domestic category and select some typical kitchen and laundry components such as Refrigerator, Cooking equipment, and laundry appliances.
27. In the Project Browser, right-click over the Sheets category and choose New Sheet. Pick Load and load a copy of the C 17 x 22 Horizontal family. In the new sheet, pick the border of the titleblock, right click and choose Edit Family. Confirm you want to open the file for editing. Delete all of the information above the Client name section in the titleblock. Refer to the drawing handouts and make the new titleblock look the same as the one shown. Use the Saveas command to save the modified titleblock as C 17x22 Horizontal-Custom. Choose Load into Projects and then select the project file you have been working on.
28. Switch to Level 1 and set the scale to 3/16" = 1'-0". Switch to Level 2 and do the same. Switch to the South elevation and zoom in on the Level labels. Rename Level 1 to 1_First Floor. Rename Level two to 2_Second Floor. Confirm that you want to rename the views.

29. Add 6 more levels. Set the names and elevations as shown below from top to bottom.

- | | | |
|--------------------|----------|--------------------------|
| • Top of Plate 2 | 19'-1 ½" | (no plan views required) |
| • 2_Second Floor | 10'-1 ½" | (plan view required) |
| • Top of Plate 1 | 9'-0" | (no plan views required) |
| • 1_First Floor | 0'-0" | (plan view required) |
| • Top of Fndn | -1'-2" | (no plan view required) |
| • Grade | -1'-10" | (plan view required) |
| • 0_Basement Floor | -9'-2" | (plan view required) |
| • T.O. Ftg. | -9'-6" | (no plan view required) |

30. After creating the new levels, add elbows where required and align the ends of the level lines. In the project Browser, delete any extra ceiling plan views. We will only require ceiling plans for the main levels – Basement, First Floor, and Second Floor.

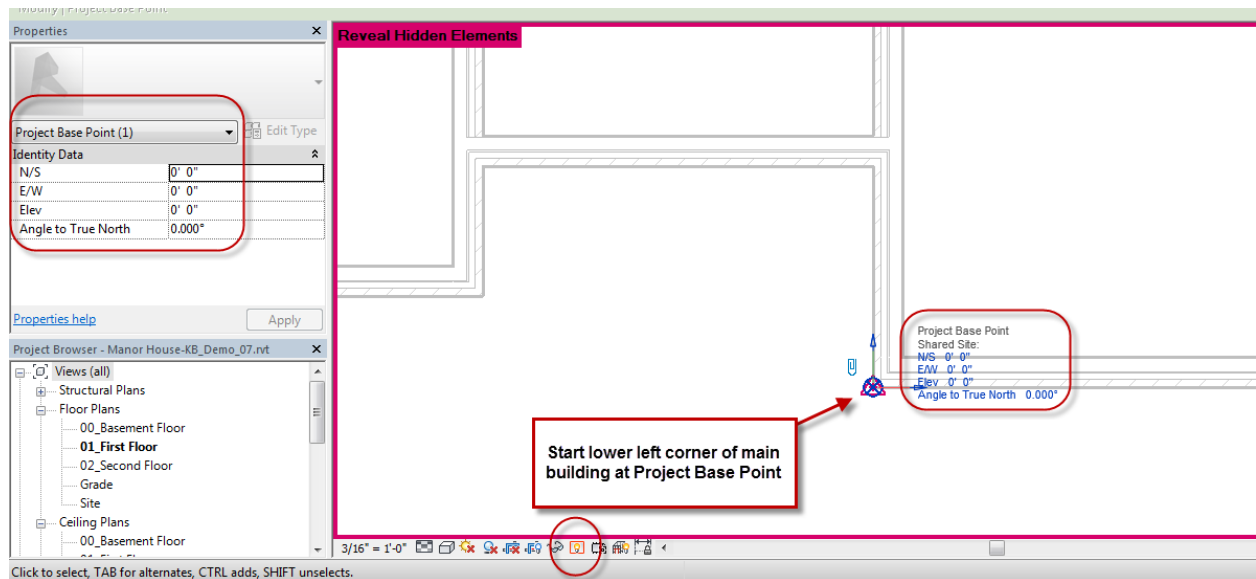
31. Switch to 01First Floor Level. From the file menu, choose Save as and in the Save file dialog, change the files of type to Template files. Name the file Revit Residential and save it in your project folder. Close the file.

32. From the Recent files menu, choose to start a new project and then browse to your new template file. Pick open and Ok to start a new, unnamed project from your custom template. Save it again with a project file type and call the file Manor House_xx where xx will be your initials. (for example, My file is called Manor House_KB for Kevin Brown.)

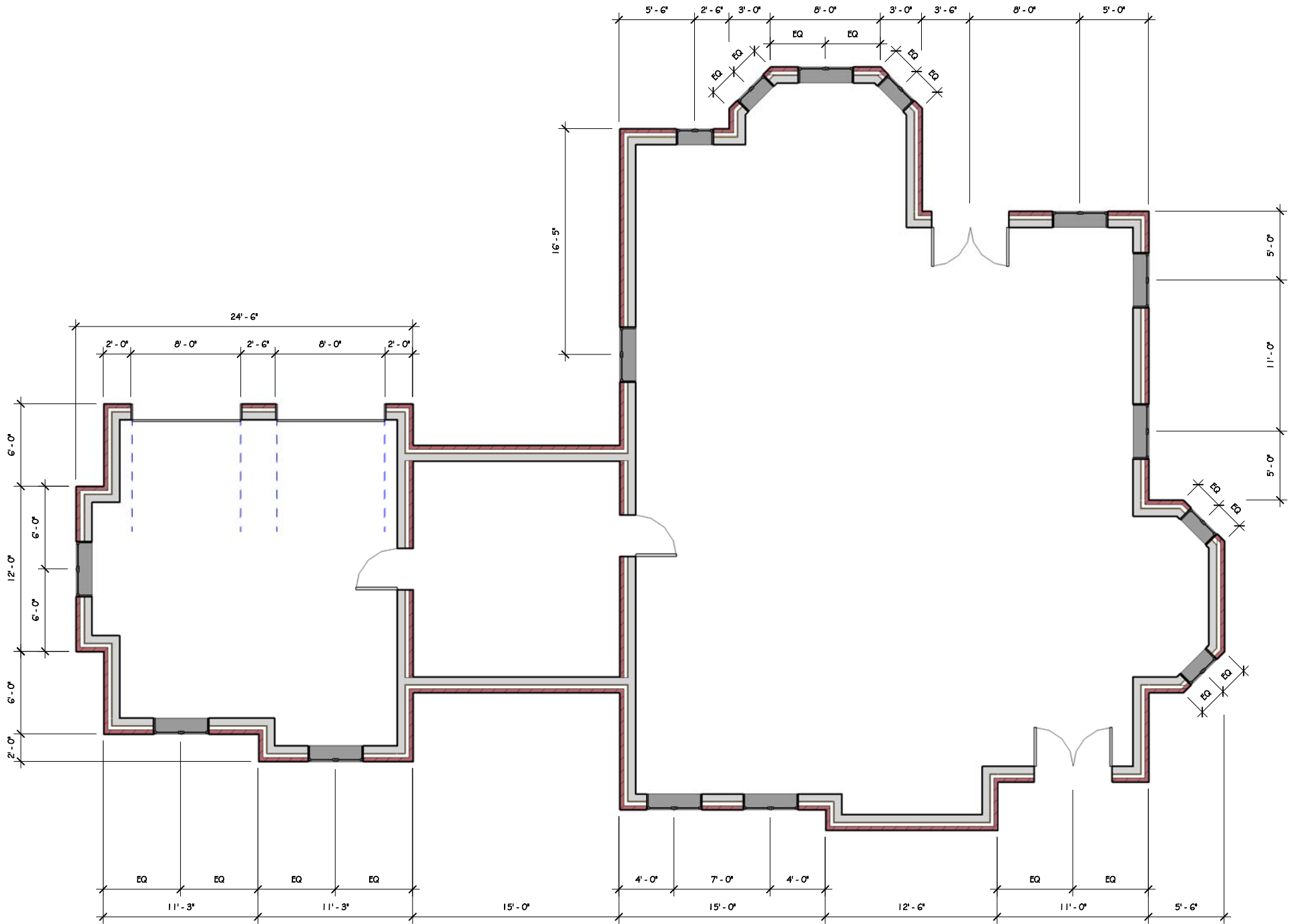
33. Refer to the Handout sheet, A-1 Floor Plan and draw the exterior walls with the wall type set to Basic Wall: Exterior – Brick on Mtl Stud. We will modify and rename this wall type to a wood frame style of construction in the next class, but for now, it will be fairly close to the size and structure that we require.

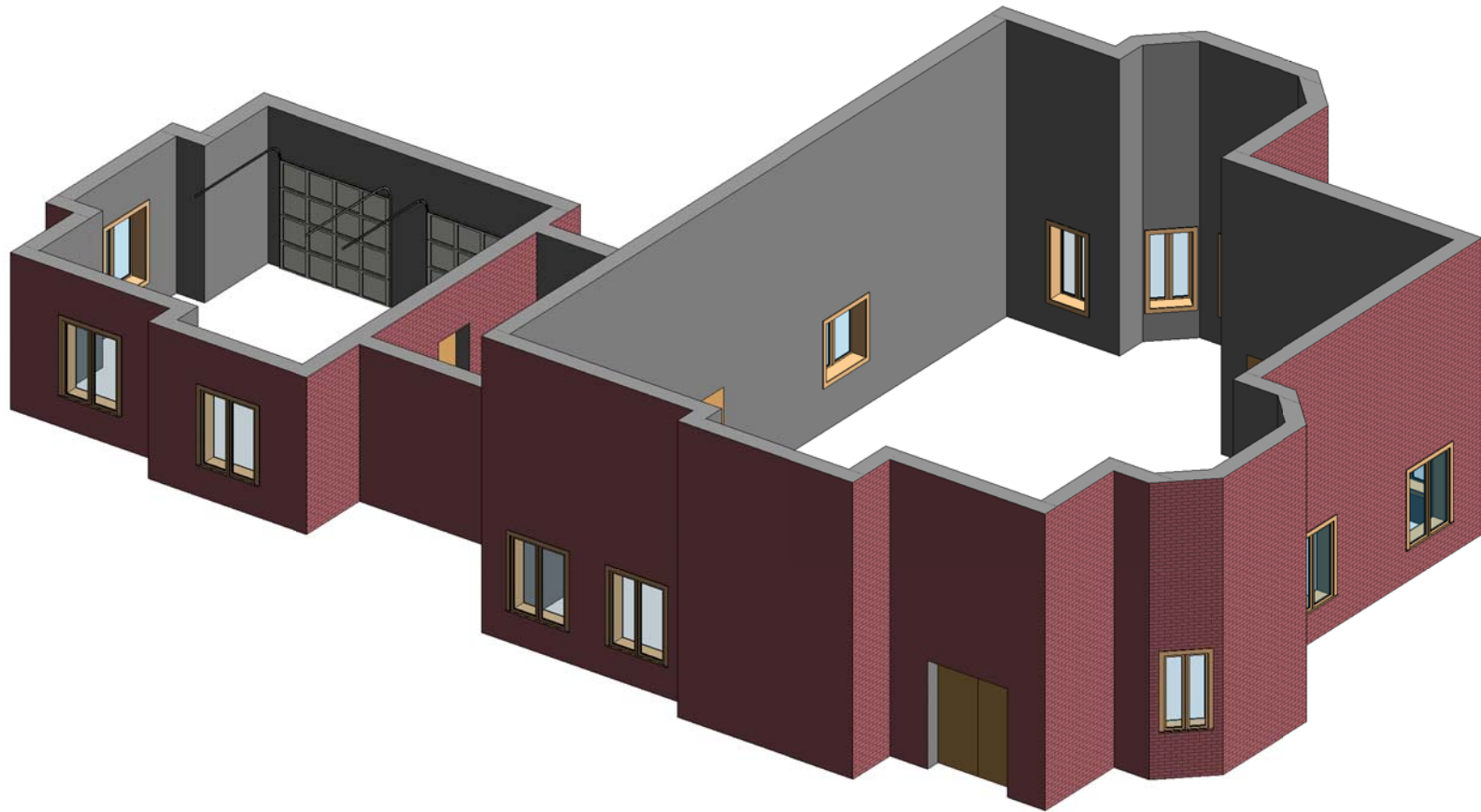
34. There two distinct sections to the Project. On the right hand side the majority of the building is two storeys and the walls you use should be set with their Top Constraint set to 2nd Floor Clg. On the left side of the plan is a garage connected to the House by a covered passageway called a Porte Cochere. The walls for the garage will be set with a top constraint at the 2_Second Floor level. Draw all walls with the Location Line set to Finish Face: Exterior.

35. Draw all of the exterior walls for both sections at the First Floor level. We will adjust the tops and bottoms of the walls with offsets and extensions in the next class.
36. Start the first exterior wall so that the lower left corner of the main building aligns with the Project Base Point. Use Reveal Hidden elements toggle to display the Base Point.



37. The angled bay window in the front elevation will be created separately in another class and for now, you can simply draw the main exterior wall type straight across in this section.
38. Add the windows and exterior doors to the exterior walls, creating dimensions to position the openings and begin the documentation process.
39. When all of the exterior walls are in place, save your project, back up your files for safekeeping and close the program. We will continue with this project in the next class.



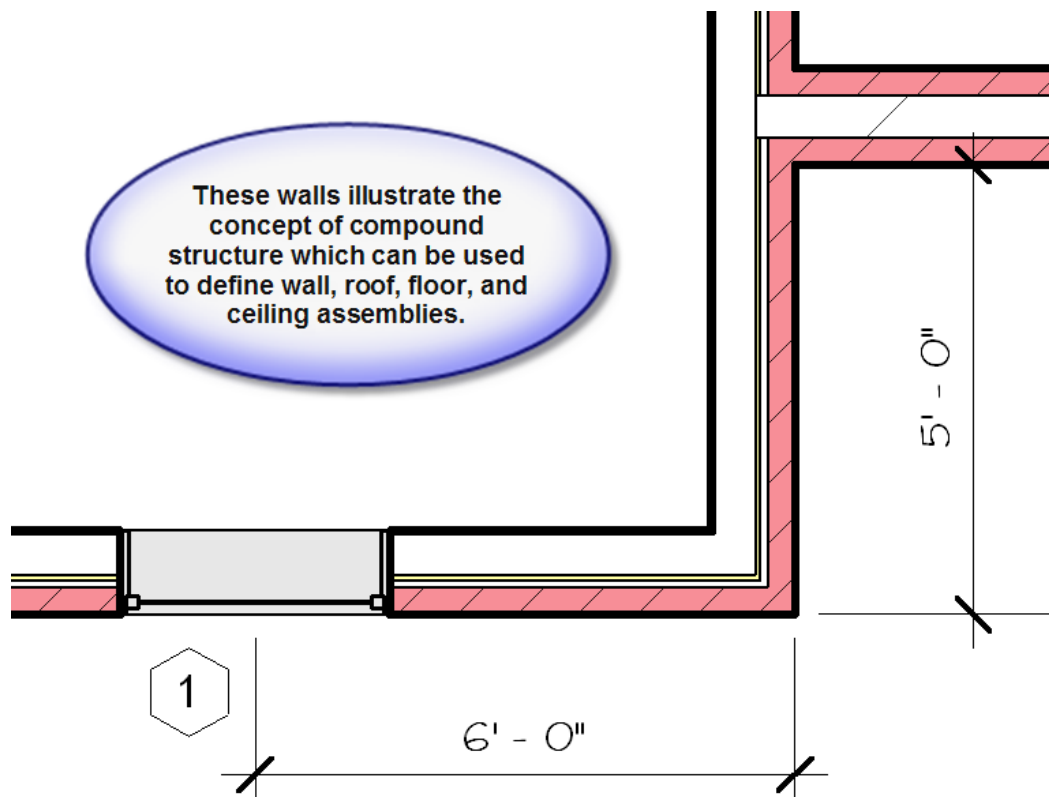


AGENDA:

1. Compound Structure and Custom Wall Types
2. Vertically Compound Walls

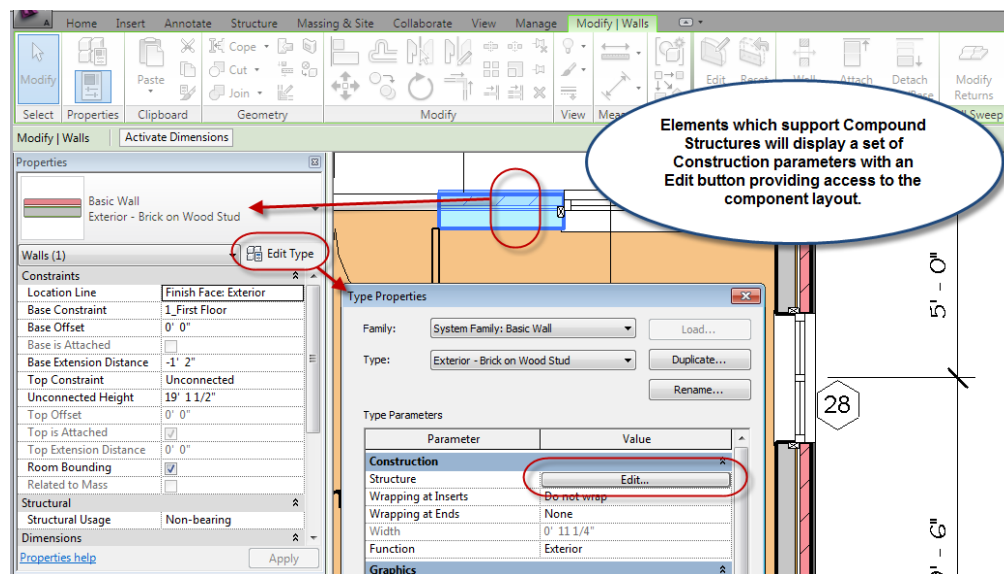
1. Compound Structure and Custom Wall Types

Many Revit elements are made up of a distinct structure of parallel layers which define components that will be required to build that element. Different layers in the structure are defined in terms of their function, thickness, and material designation.



Layers in a compound structure may have a continuous thickness as in the brick veneer in the walls shown above, a zero thickness for objects that have only a negligible thickness like vapor barriers, or their thickness may represent the overall zone in which objects are added as in the case of studs, joists or rafters. These elements only occupy space every foot or two but their overall space in the assembly still represents a layer with a thickness.

To access the structure makeup and settings for an element that supports compound structure, in the properties palette for the element, choose the Edit Type button and then in the Construction parameters section, pick Edit to open the Edit Assembly dialog where you modify the existing structure and delete or insert new layers.



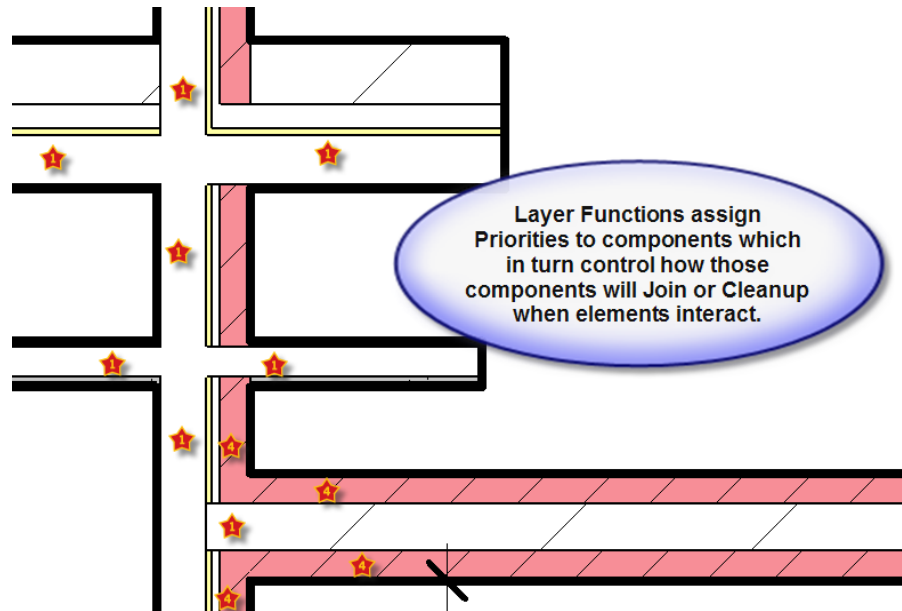
Each layer that makes up a compound structure sub category is usually assigned a material. If a material is not explicitly assigned for that layer, the material will be set to By Category. This means that the default material assigned to that category in the Object Styles dialog will be used.

The material is used not only to define the appearance of the layer but also to describe what comprises that layer. For example one layer might be used to define an empty air space in a brick veneer wall but that layer will still be assigned a material. The miscellaneous air layer material is a pure white color with no fill patterns. A wood flooring material, on the other hand, could be assigned to the $\frac{3}{4}$ " thick Finish Wood Floor layer in a floor assembly.

The materials in layers will display fill patterns in both cut and projection style views if those materials have fill patterns assigned. Material fill patterns only display when the view detail level is set to Medium or Fine. It is possible to have the same pattern or a different pattern and different color assigned to the Coarse Scale Fill Pattern field in the Type Properties dialog. Pattern and Color may be assigned in the Graphics category of parameters.

Each layer within a compound structure has a specific function assigned to it. These functions in turn define a priority which is used to control how layers join each other when two or more elements with a compound structure meet each other or cross each other.

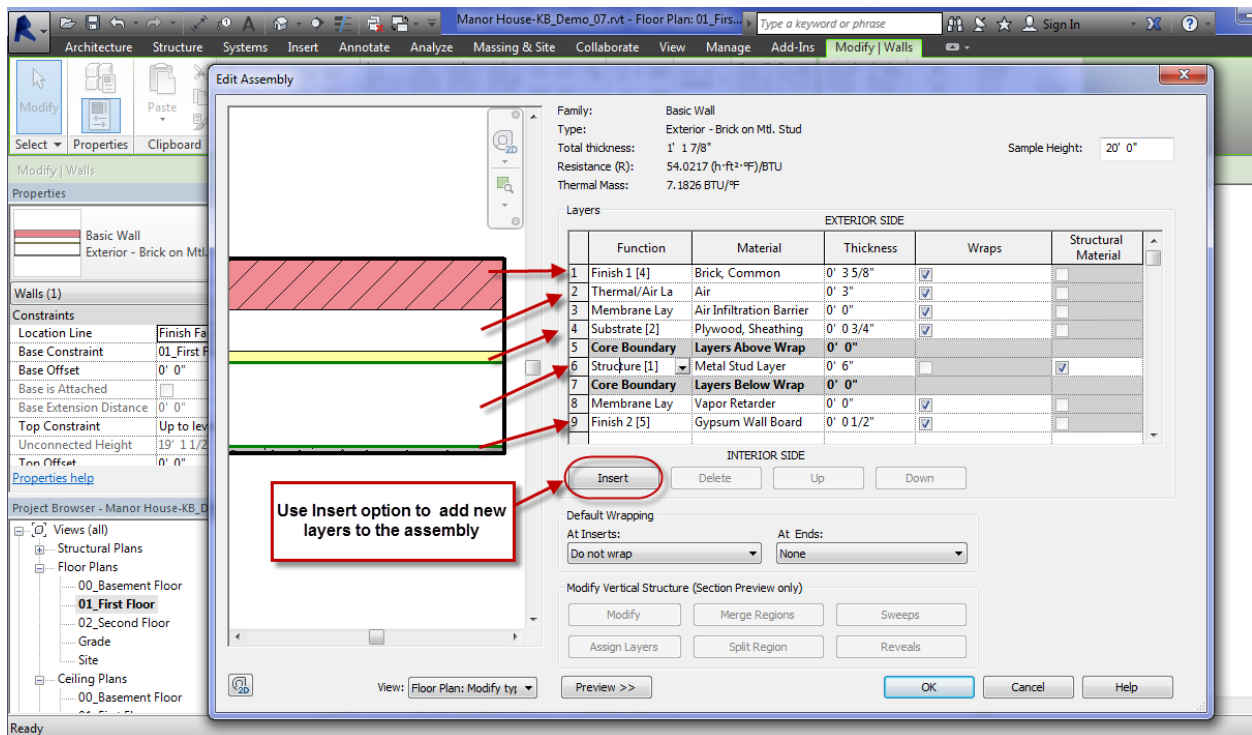
There are 5 layer functions each with an assigned priority. Higher priority components will cross or cut through lower priority components. Components with the same priority and the same material will clean up. If the function is the same but the material is different as in the case of a structural wood frame wall meeting a concrete block wall, a line appears between the joins.



The available functions which can be assigned to a layer are:

1. **Structure** (Priority 1) – This layer acts as the main support for the assembly such as a concrete block wall, floor joists, or rafters.
2. **Substrate** (Priority 2) – Substrate supports another material and is usually assigned to layers such as plywood sheathing or furring strips to support shingles or siding.
3. **Thermal/Air Layer** (Priority 3) - This layer is used for insulation or rain screen barriers.
4. **Membrane Layer** – This layer usually provides a barrier to moisture in liquid or vapor form. An example would be a layer of 6 mil polyethylene Air/Vapor barrier.
5. **Finish 1** (Priority 4) – The exterior finish layer such as bricks or shingles.
6. **Finish 2** (Priority 5) –The interior finish layer for gypsum wallboard typically.

Custom assemblies are defined by inserting new layers or modifying existing layers. You can make a wall or floor assembly from a simple generic wall with a single layer as a starting point but it is usually faster to look for a type that is already similar to what you need. You may need to just modify a single layer thickness or change a single material to obtain the desired wall type for your project.



Layer Wrapping settings allow you to specify how you want components in your assembly to be treated at open wall ends (end wrapping) and at openings such as doors and windows (insert wrapping). When you enable wrapping, the finish layers will wrap around the ends of the other layers, concealing them and showing only finish materials at that location.

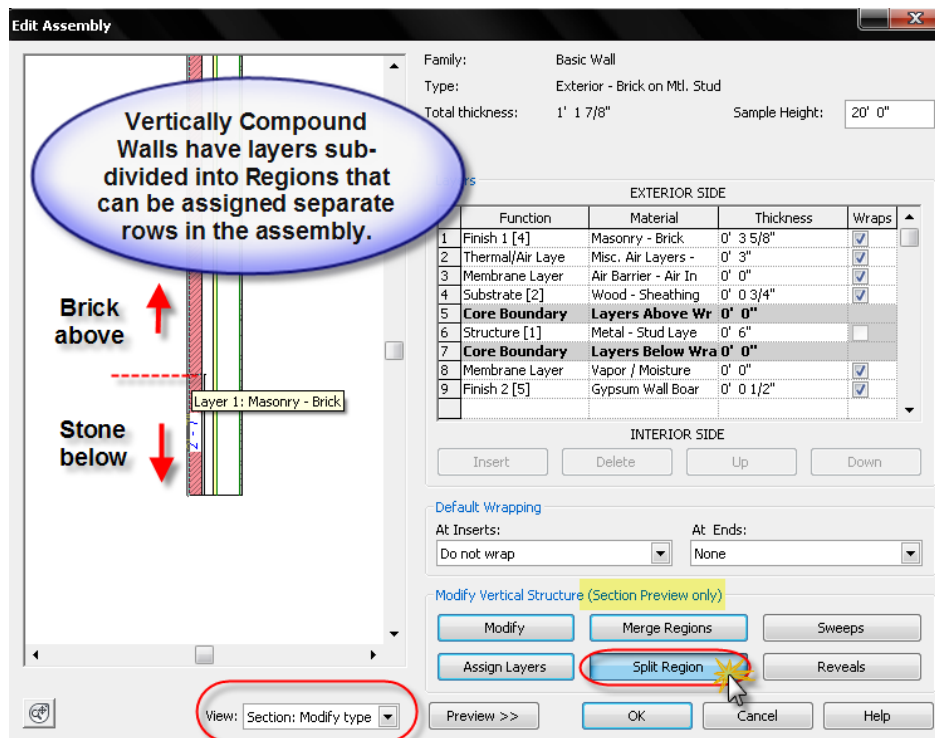
When you enable wrapping for Ends, you can choose the exterior components to wrap around the core to meet the interior finish, or the Interior components to wrap around the core and meet the exterior finish.

When you enable wrapping at inserts, you can choose Interior, Exterior, or you can have both finish components wrap at the same time.

2. Vertically Compound Walls

Compound Walls can be subdivided vertically, within the main structure, by defining vertical Regions and assigning Layers to those sub-regions within the main horizontal divisions of the wall.

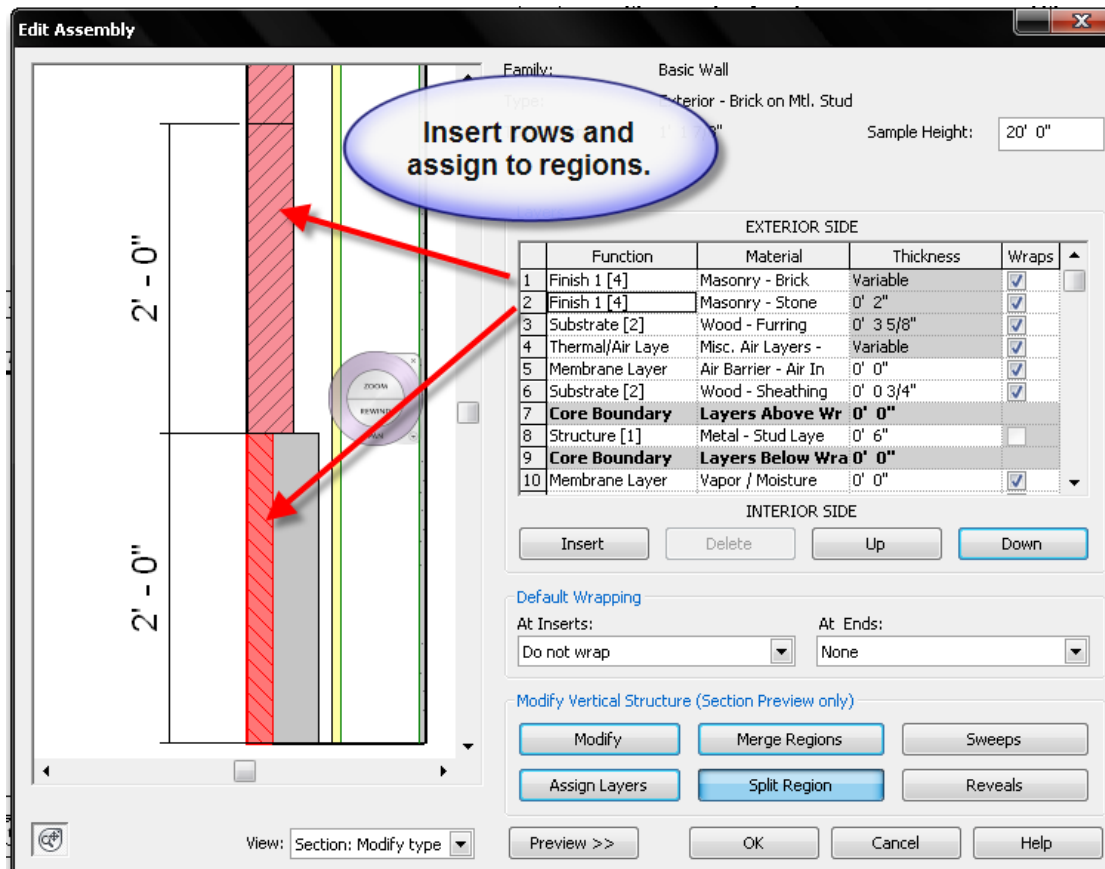
In a compound wall, each material component defined by a layer within that wall assembly, has a single thickness and the layer extends from the bottom to the top of the wall.



To subdivide a layer, set the view type to Section and use the Split Region tool to define a split location. If you zoom in a bit in the preview window, you can choose a point along one of the borders between layers and an edge will highlight, indicating which layer will be split.

After splitting a layer vertically, you have two resulting regions, each of which will be using the material and function of the original layer. To assign a new function and or material to one of the regions, Insert a new row into the assembly table, set the parameters for that row, and then with that row highlighted, pick the Assign Layers button and select the region to which you wish to assign the new row properties.

When you split a region vertically, a dimension will be shown in the preview window. To change the height of a region, pick the Modify button and then select the border between the two regions. This will highlight the dimension value and allow you to enter a new distance.

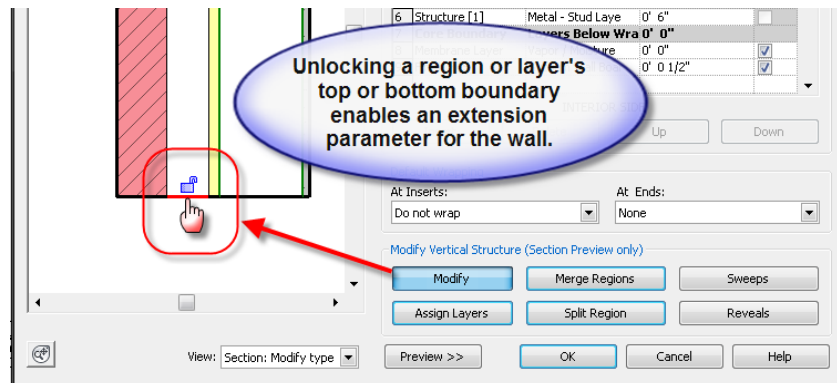


As you can see in the example above, the Split Region tool will also work to create vertical split lines in an existing layer or region. If you wanted to split an entire layer over the extents of the wall, just insert a new layer. If you want to split a region into two vertical sections, use the Split Region tool and pick a point along the horizontal border at the top or bottom of the regions. A temporary dimension will appear which you can use to set the width of the sub-region. The region width can also be set by dragging the internal border.

To reverse a split region, use the Merge region tool and move your cursor over the border between the two regions. A small rectangle and arrow icon will appear indicating which region properties will be assigned to the merged region.

When adjusting the width of a region, the overall width of the wall must remain constant. It is not possible to pull the outer face out of line with the face above. This is only possible by creating a Stacked Wall or through the use of Wall Sweeps. One other possibility would be to model the wall as In-place families. We will cover all of these methods in a future class.

It is possible to vary the heights of individual layers within the overall wall assembly relative to the top and bottom of the wall. If you choose the modify button and then pick a layer or region boundary at the top or bottom of the wall sample, it will enable

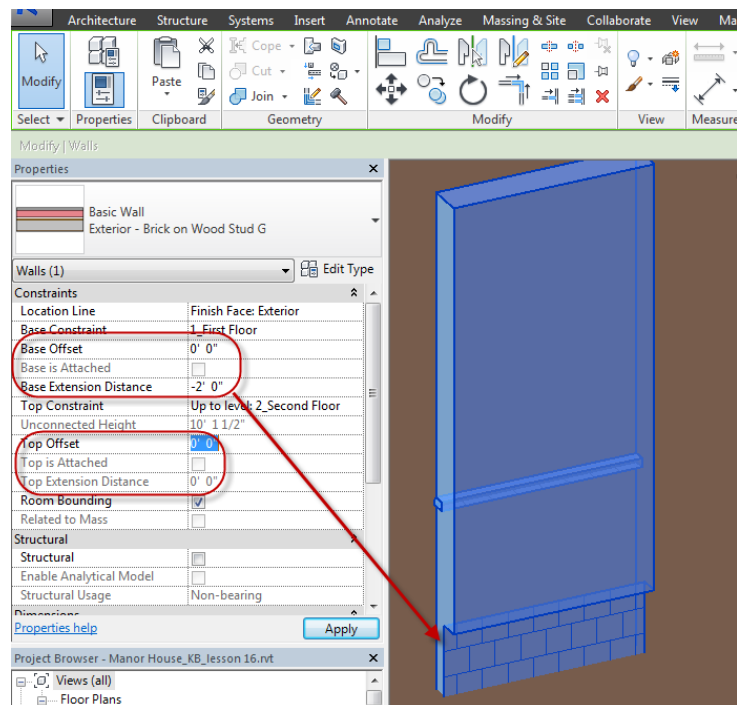


a layer extension value which will appear in the Instance parameters for the wall's element properties.

Top Extension parameters allow you to vary the height of one or more adjacent layers in the wall either above (positive distances) or below the default wall height set by the top constraint or unconnected height value. Bottom Extension parameters allow you to vary the height of adjacent wall layers above or below the base constraint for a selected wall.

Extensions will be applied relative to any offsets which will be evaluated for the top or bottom location for a wall. Base

offsets and Top offsets will adjust the height of all wall components above or below the default height or constraint location. Any extension distances will then be applied on top of the offset distance.



Exercise Notes

In the following exercises you will create a few custom wall types for your main project, assign new types to the exterior walls and then use others to add the interior walls for the first floor.

1. Open your Manor House project. All first floor exterior walls should be in place including all doors and windows. The exterior walls should be dimensioned but not locked. Try to keep the number of locks and constraints to a minimum.
2. Pick one of the main exterior walls, and in the Properties Palette, pick Edit Type and then Rename to change the name to Exterior – Brick on Wood Stud. In the structure field, choose the Edit Button to open the assembly editor.
3. In the view field below the Preview window, set the view type to Floor Plan. In the layer table at the right side, pick in the Thickness field for Layer 2, the air space, and reduce the thickness from 3" to 1". Pick in another field to update the preview window.
4. In the Core section, Layer 6, pick in the material field where it says Metal-Stud layer and then pick the Browse button to open the Material browser. In the Project Materials section in the upper left, choose the **Softwood Lumber** material and pick Ok. In the thickness field for the Wood layer, reduce the value to 5 ½". In Layer 4, set the Wood Sheathing thickness to 5/8". Pick Ok twice to close the dialog boxes and apply the changes. All of the exterior walls should have updated to reflect the new name and the new parameters for the custom wall type. Because we drew the walls with the location line set to the exterior face, the outer dimensions of the walls remain constant and the reduced thickness of the assembly is reflected in the larger interior spaces.
5. Switch to the default 3D view. Select bottom right corner of the View cube to switch to an isometric view from below the building and looking up at the bottoms of the walls. Zoom and pan your way into the left corner of the garage where you can see examples of inside as well as outside corners of the walls. This will afford a good view of the changes we'll make. If the view appears too dark change your visual style to Consistent Colors.

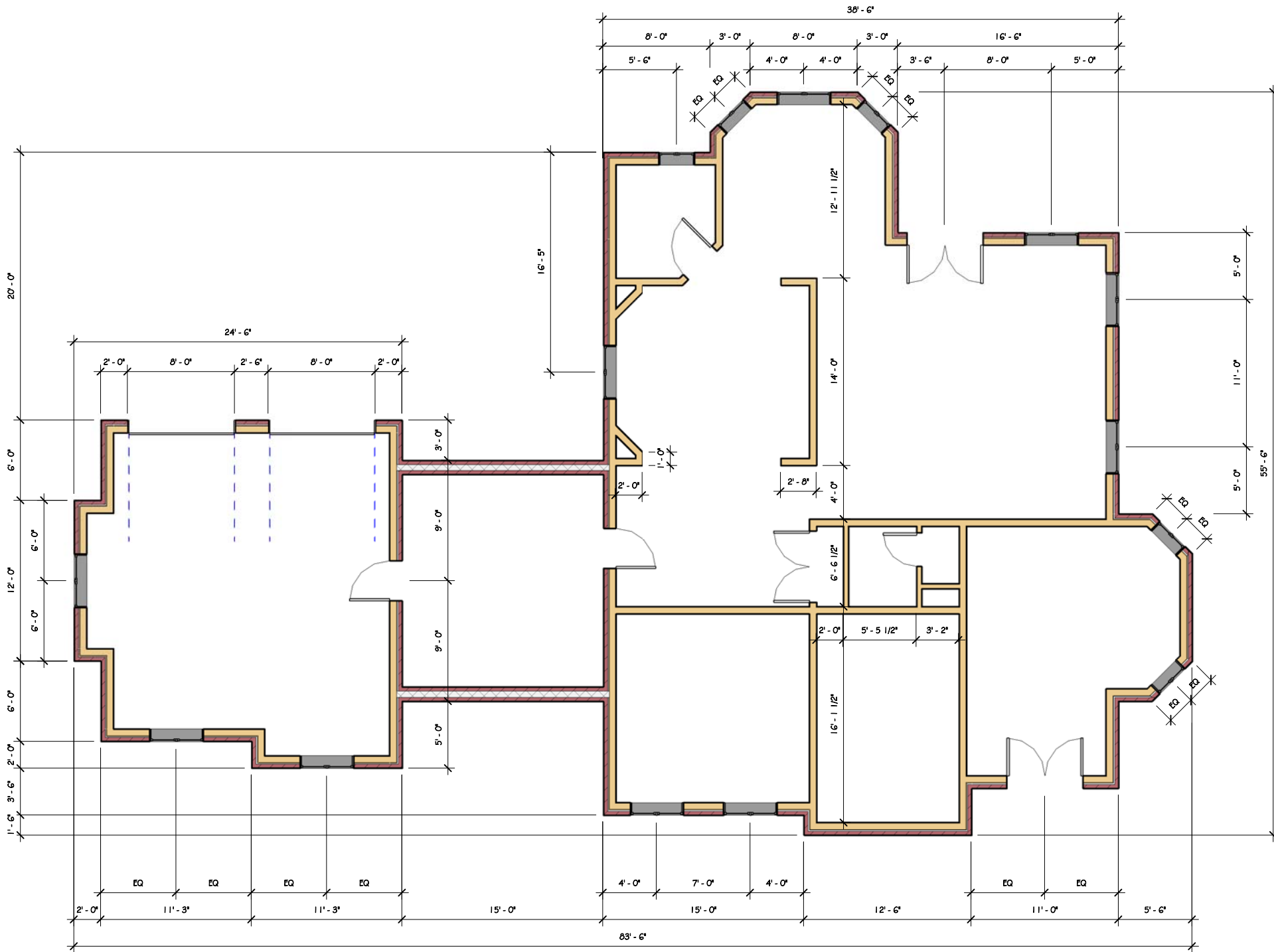
6. In this type of wall, the bottom of the wood studs and interior finish will be on top of a floor structure which will be supported on a foundation wall. The outer components of brick, air space, and sheathing will extend down in front of the floor assembly with the brick resting on the foundation. The sheathing will end slightly above that point to maintain proper transfer of loads through the framing system but we will include that detail in a drafting view. It is important to try to get the larger elements modeled correctly and then leave the minutiae to details and specifications.
7. Select one of the exterior walls and pick Element Properties. The Base Constraint is set to First Floor and the Base Offset is set to 0' 0". Try setting the Base offset to 2' 0" and pick OK. The wall base moves up 2 feet. Repeat and try the offset at negative 2' 0". The entire wall bottom is adjusted as one element. Hit CTRL-Z until the wall returns to its normal base, aligned with the other walls.
8. Pick the wall again, and type SA to select all instances. In the properties palette, pick Edit Type. Pick the Edit button by Structure. Change the View type to Section.
9. Place your cursor over the bottom of the wall and turn your mouse wheel to zoom in until the wall width fills the preview window and you can see the bottom edges of the wall. Pick Modify and then select the border under the brick layer to display its lock toggle. Unlock the element and then repeat for the two adjacent layers – air and sheathing. Pick OK twice to close the type properties.
10. In the Properties palette, set the Base extension distance to -1'2" and pick OK. After a brief pause the walls will redraw with the unlocked layers moved to the extension level. The inner face of the components extending below the base of the wall will show the same material as the exterior face. This is incorrect, as we should actually see the material for the plywood sheathing but it is a limitation of the software. This portion of the wall will be concealed by a floor system however so the appearance will not cause any problems.
11. Pick the wall again and open the element properties. Pick Edit/New and Edit again to open the assembly editor. Pick the material field for the gypsum wallboard and open the Material Browser. In the shading area pick in the color swatch area and then choose a paint color. I created an Antique White but any color you want to look at for the next while is fine. 😊 Pick Ok until you're back out to the model.

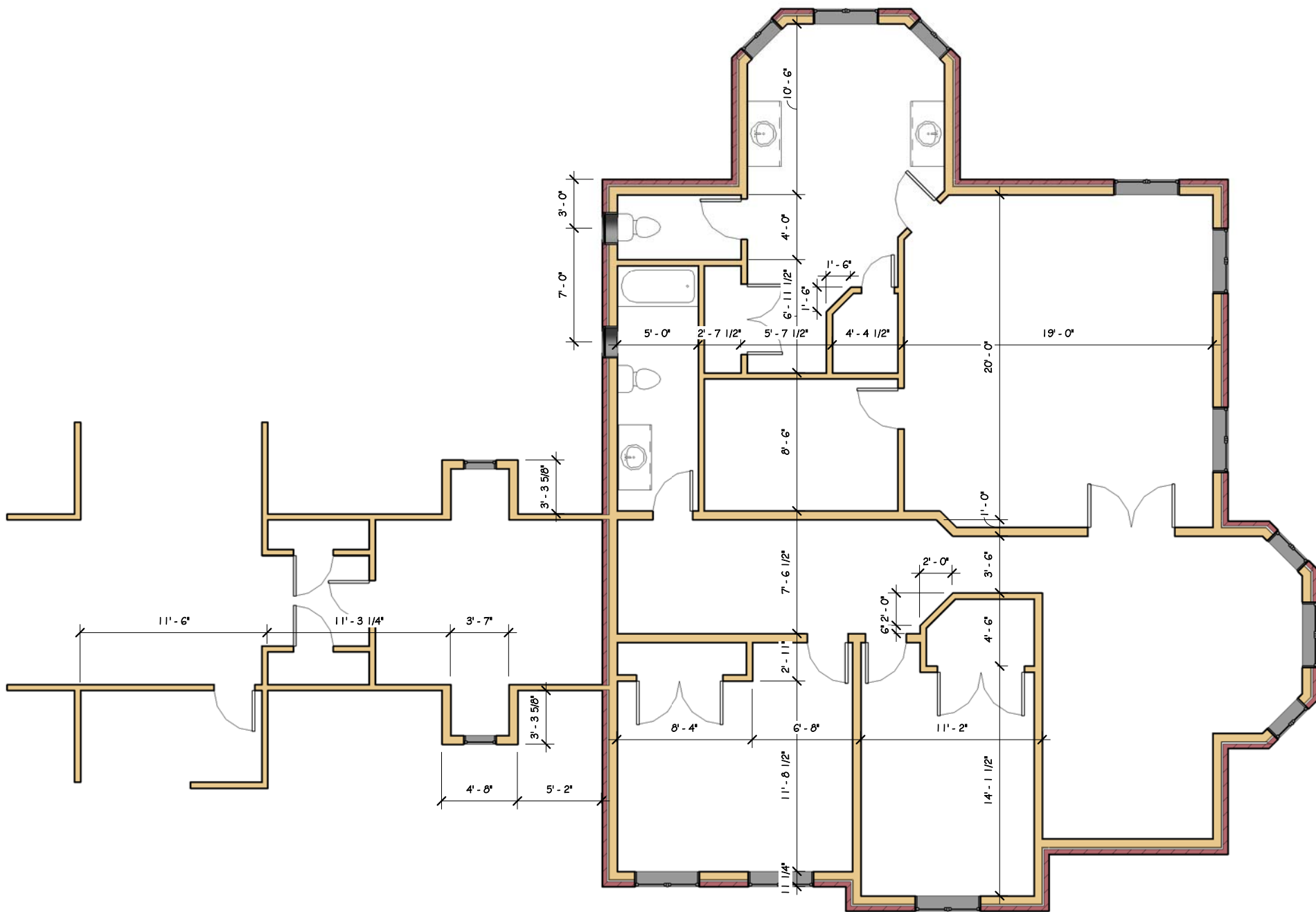
12. Pick the wall again and go back into the assembly editor. Zoom in around the lower section of the wall. Pick the Split Region tool and move your mouse over the brick layer. Pick a point approximately 2 feet above the base. Pick the Modify button and select the new border line at the top of the split region. Set the dimension to 2 feet.
13. Pick the top layer in the list of layers and pick Insert. Set the function of the new layer to Finish 1. Pick the material field and in the Material browser, look in the lower left section and under AEC Materials, choose the Stone Category. Pick the Limestone material and double-click to add it to the current document.
14. In the upper left section under Project materials, pick the new Limestone material. In the Graphics tab, in the surface pattern field, pick the empty swatch and set the fill pattern to Block 8x8. (use the Model Pattern Type option) Set the Cut Pattern to Diagonal Down. Pick Apply. Switch to the Identity tab, set the Class to Masonry, and then rename the material to Stone Veneer. Pick Apply.
15. *****Optional - To get a better appearance for the stone surface pattern, try creating a custom pattern by importing the supplied Castle Stone.pat file and setting the scale to 25.***
16. Pick the checkmark by Use Render Appearance for shading. Pick the Appearance tab to see what the material will look like in a realistic view. Pick the image swatch to open the Texture Editor. Increase the sample size width from 1'-10" to 4'-7" to better reflect the actual dimensions of the number of stones shown in the sample image. Pick Done to close the Texture Editor. Pick OK to close the material browser. Now for the tricky part. ☺
17. Pick on the new row in the list of layers. Pick the Assign Layers button. Pick the new region you create at the bottom of the wall until it highlights in blue and the hatch pattern changes. Pick the modify button and you should see a different color in the stone region. If it looks like brick still, repeat the process of picking the row, assign, and then the region.
18. Pick Modify again and then select the border at the bottom of the stone region. Unlock the border. Pick OK three times to close the dialogs and return to the drawing.
19. The two walls between the house and the garage are going to be a different construction and will have a single layer of brick on both sides of a 6" thick concrete block wall. Select the two walls and change their type to Exterior – Brick on CMU. Pick Edit Type on the properties palette. Rename the wall to Exterior-Brick on CMU – 2 sides. Pick edit to access the structure of the wall.

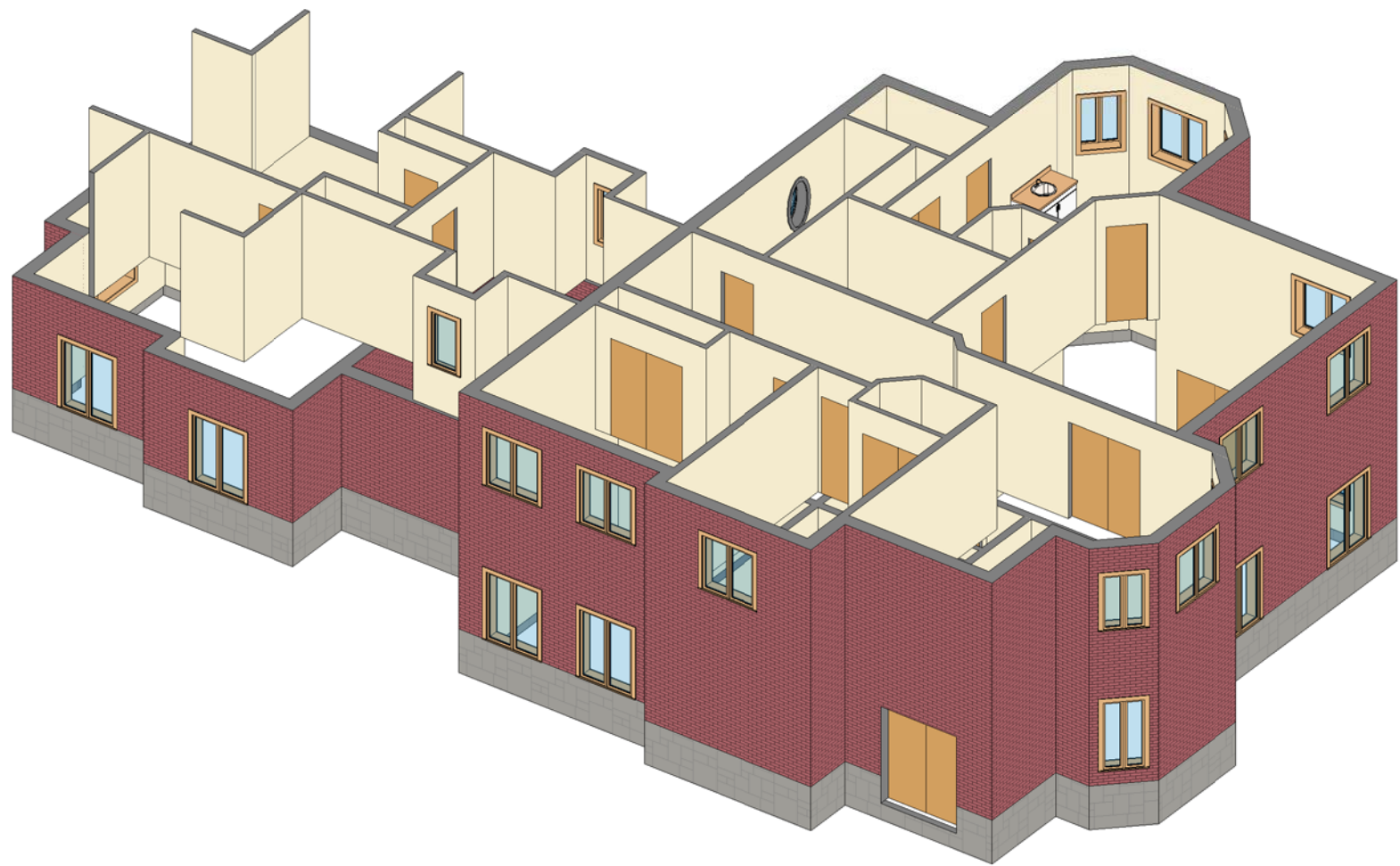
20. Highlight the second layer, for the 3" air space and pick Delete. Pick Delete twice more to delete the insulation and vapor barrier layers, leaving only the brick on the exterior side of the core. Pick the 5th layer, Metal furring and delete it. Pick the gypsum wall board material and in the Material dialog, select the Masonry Brick material. Increase the thickness of this layer to 3 5/8". Change the function from Finish 2 to Finish 1. Change the thickness of the masonry concrete layer to 5 5/8". Pick OK to close the dialogs.
21. The walls change configuration but if you look at them in 3D, you can see that they are above the other exterior wall bottoms. To get them to drop to the foundation level we can apply a base offset or simply change their base level constraint to T.O. Fndn level. Take the latter approach.
22. Edit the new wall style again and create a 3' 2" tall stone section at the bottom of each face of the wall. Use Split Region twice, Insert two new rows in the assembly table, set them to a finish function and a stone material and assign them to the new regions.
23. Switch to the Second Floor view. Before we add the interior walls we need to make a change in the upper left corner of the main building. In this corner the walls do not extend over two storeys, but are only a single storey in the laundry room. Zoom in to this area.
24. From the inside corner where the bay section at the back joins the horizontal wall on the left side start a wall with the exterior wall type. Access the element properties and confirm that the wall is constrained between the Second Floor and the 2nd Flr Clg levels and is not using any offsets or extensions. Draw the wall straight down six feet and then go left to meet the existing exterior wall.
25. Where the new, horizontal wall section meets the existing exterior wall, apply a trim command to create a clean corner. Select the short horizontal wall section at the top and access its element properties. Change the top constraint to 1st Flr Clg. Switch to the 3D view and get a look at the back corner of the building so you can see what you're doing so far.
26. Switch to the Floor 1 view and zoom into the corner we're working on. Pick the horizontal wall you just changed and choose create similar. Pick a point at the end of the vertical wall section and draw a wall up to meet the horizontal wall. It should clean up automatically but if not, use the Trim tool to clean the corner.

27. Switch back to a 3D view and checkout the inset corner on the second floor. The first floor walls will be covered with a roof in the next class so don't worry about the connection between the first and second floor where you may see a notch.
28. We don't need to see the stone portion of the exterior wall on the second floor in this area. Select the two, second floor walls, right-click and choose element properties. Pick Edit / New and Duplicate. Name the new style Exterior – Brick on Wood Stud 2. Edit the structure and use the Merge Region tool to merge the stone section with the brick section above. If you zoom in and float your mouse over the border between the two regions, a tooltip will appear letting you know which layer will be assigned after the merge. After you merge the regions, delete the stone layer in the assembly and pick OK.
29. After removing the stone portion, review the wall connections in both floor plan views. Switch to a 3D view and admire your handiwork. The garage walls are actually going to have a different condition at the bottom of the wall so we'll now adjust the garage walls. The same Wall type will work if we adjust the base constraint and extension. Float your mouse over one of the garage walls, press TAB and pick to select all of the walls around the garage. In the Properties palette, change the Base constraint to T.O. Fndn. and the Base Extension to zero. Pick Ok.
30. While we are working on the garage we should drop the level of the doors to T.O Fndn. Pick the door from the garage to the Porte Cochere and view its properties. Set the Level to T.O. Fndn and pick OK. Repeat for the garage doors but set them to Grade level.
31. We can now start adding the interior walls. First let's create a new wall type by duplicating an existing interior partition 4-7/8" wall type. Name the new wall type Interior – 4 ½" Partition. Edit the structure and change the thickness of the stud layer to 3 ½" and change the material to Wood – Stud layer. Change the thickness of the Gypsum wall board layers to ½" each bringing the overall thickness to 4 ½" Pick OK and duplicate the wall type again.
32. Name the new wall type Interior – 6 ½" Partition and edit the structure to change the thickness of the stud layer to 5 ½". Pick Ok. In the Identity Data parameters, delete the Assembly code field. We will cover assembly codes in a future class. Pick Ok.

33. Start laying out the interior partitions for the first and second floors using the new wall types. If it is a main wall, use the 6 ½" partitions and for smaller walls use the 4 ½" partitions. When working on the second floor, use the underlay function to help align features between floors. Interior walls should align with the jogs in the exterior walls so you may want to start laying out the interior partitions at the exterior jog locations.
34. Add doors and any remaining windows in the main portion of the house. The windows in the guest suite over the garage will be added after we create the roof and extend the first floor exterior walls up to meet the roof.
35. *There may not be enough time to demonstrate the creation of all of the walls in the video demonstrations for this lesson. There is nothing new however in drawing walls, and adding a few doors. Use the dimensions on the handout drawings and your existing skills to complete the interior layouts. Feel free to make your own choices for door and window types but try to keep the locations the same as shown on the handout.*
36. Save and close the file and we will continue in the next lesson.







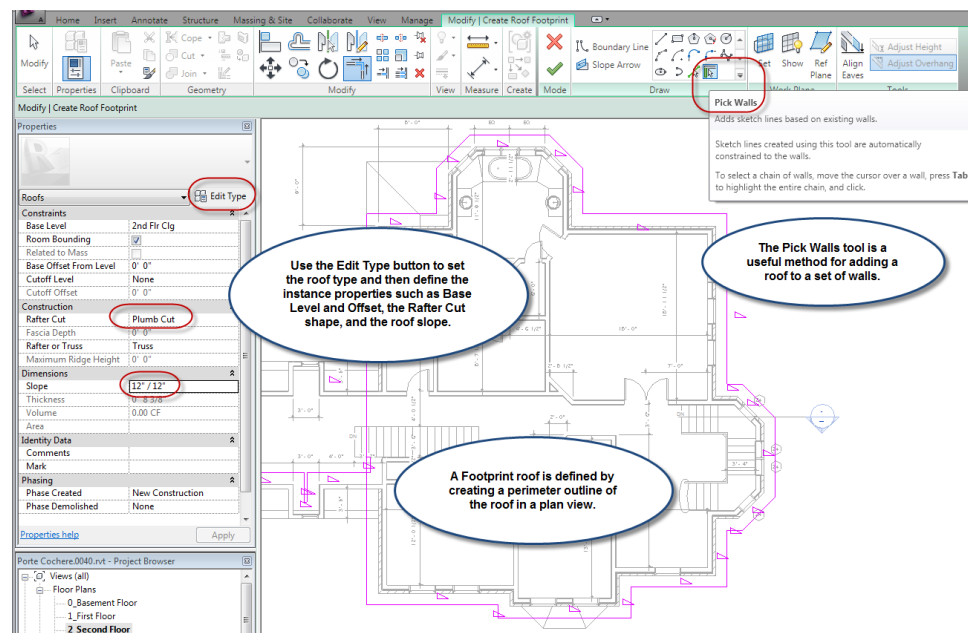
AGENDA:

1. Creating and Modifying Footprint Roofs
2. Joining Roofs and Attaching Walls
3. Extruding Roofs and Adding Dormers

1. Creating and Modifying Footprint Roofs

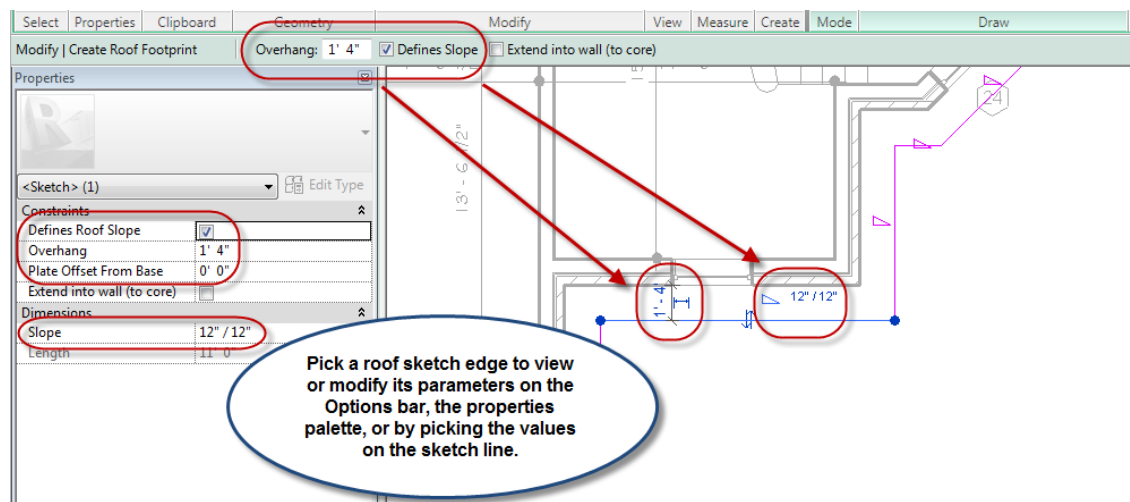
Roof elements in Revit may be defined with a Footprint or as an extrusion. Complex, curved roofs may also be created by deriving the roof from the Face of a massing model.

The most common method of creating a roof is the footprint method in which you specify the outline of the roof perimeter, usually in a plan view. The footprint can be defined by picking walls, by drawing lines or a combination of both methods. The perimeter sketch of a footprint roof must form a closed loop. Any inner loops inside the roof perimeter will define holes or openings in the roof.



The footprint sketch is defined at the level of the Plan view which is current when you draw the sketch unless you specify a different base level in the Roof properties. For example you can draw the perimeter sketch in the Second Floor level but set the roof to be constrained to the Second Floor Ceiling level.

As you sketch a roof footprint, the Options Bar displays a Defines Slope toggle as well as an Overhang distance. These values may be changed as you are creating the footprint or after the main footprint has been defined. When you turn off the Defines Slope option for a roof segment, that section of roof will extend vertically creating a gable roof.

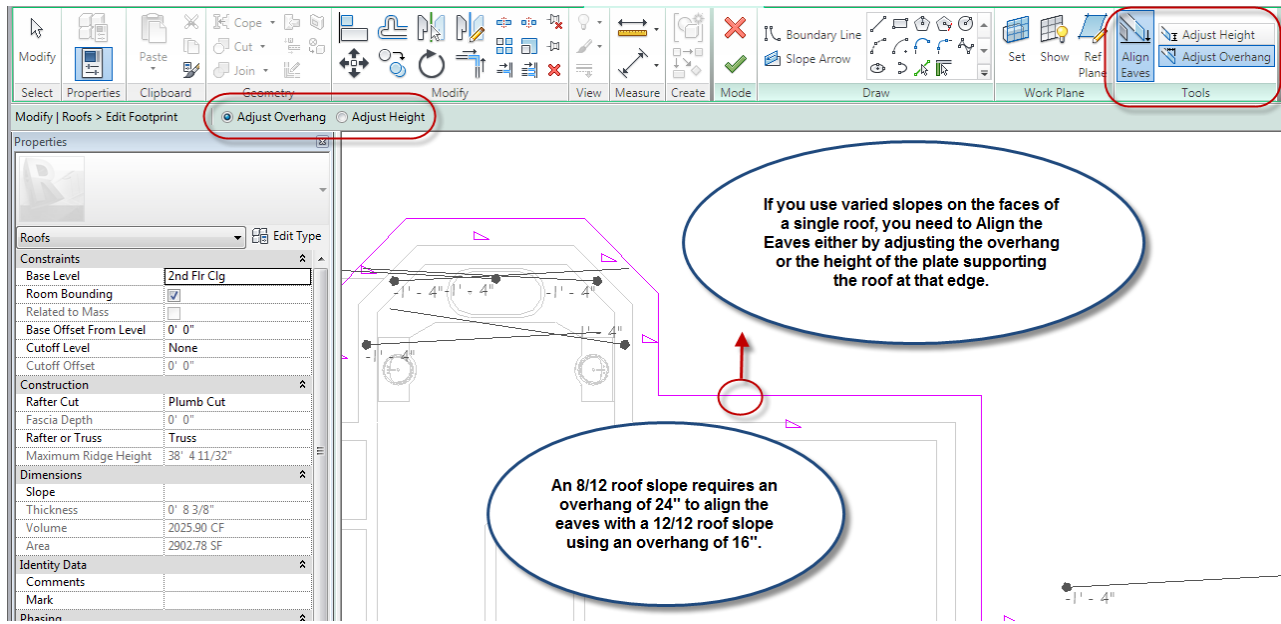


toggling the define slope option for various segments of a roof sketch will define different types of roofs. Turn off the define slope on all sides and you get a flat roof. Turn it on all sides and you get a hip roof. Each time you turn off the slope for a selected edge of a complex footprint, that edge will form a gable so it is easy to create a roof with a combination of hip and gable sections.

When you first define the roof footprint, you can use the Properties palette to set the Base level, an offset from the base level, construction options, and the slope for all segments of the roof that are defined with a slope line.

A footprint roof can also have different slopes for different faces. When you pick a single edge in the footprint sketch, the slope value as well as the overhang distance for that segment will be displayed. If you pick the dimension for the overhang or the rise over run slope indicator, you can modify the values. This would let you define a hip roof with a 12/12 slope on the sides and a lower 8/12 slope on the back face of the roof, lowering the overall height of the roof and modifying the appearance of the roof line. When you introduce varying slopes on a roof, the roof properties dialog displays an empty field for the slope. Entering a value will apply that slope to all segments.

When you apply different roof slopes to adjoining faces of a roof, the eaves component of the roof will no longer be aligned. The eaves position is defined through a combination of roof overhang distance, wall height, and roof slope or angle.



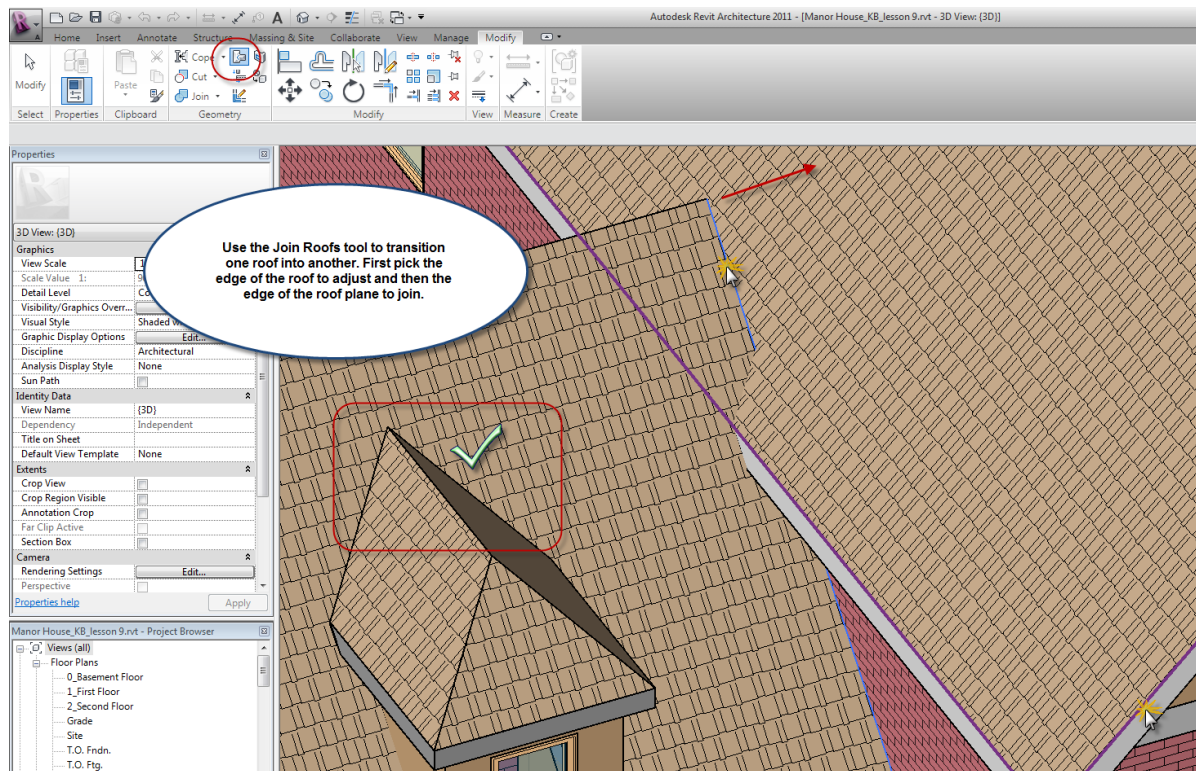
The Align Eaves tool may be accessed when you are creating the roof or after it has been created and modified, by picking the Roof and then selecting the Edit button on the Options Bar to go back to the roof sketch mode. Pick Align Eaves, select a roof edge that you want to align to and then pick the edge that you wish to align. The overhang distance will be adjusted and when you pick Finish Roof to exit sketch mode, the roof eaves will be aligned.

Eaves may be defined with different rafter end cuts which will modify the size and shape of the eaves. If you want a vertical face on the ends of the rafters, choose a Plumb Cut or a two-Cut Plumb shape. If you want the ends of the rafters to be aligned perpendicular to the slope of the roof, choose Two cut Square.

Choosing a Two cut method opens up a value for a Fascia Depth which can be specified between zero and the thickness of the roof. This is useful for reducing the depth of the exposed eaves. A plumb cut eave on a 12/12 roof with an 8" thickness will create an eaves depth of over 11". Setting a Plumb Two cut will allow you to reduce that distance to 8" or 6".

2. Joining Roofs, and Attaching Walls

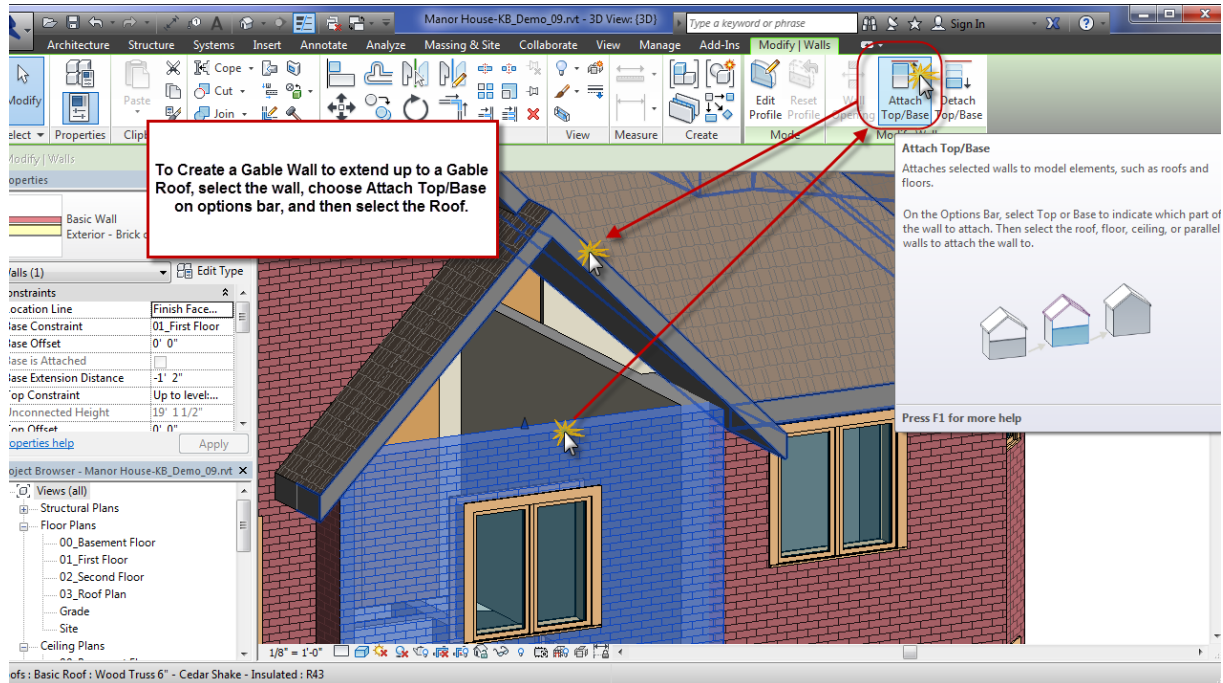
Roof elements may be joined together to create a connection between a vertical edge on one roof and a sloping face on an adjacent roof with the Join Roofs tool.



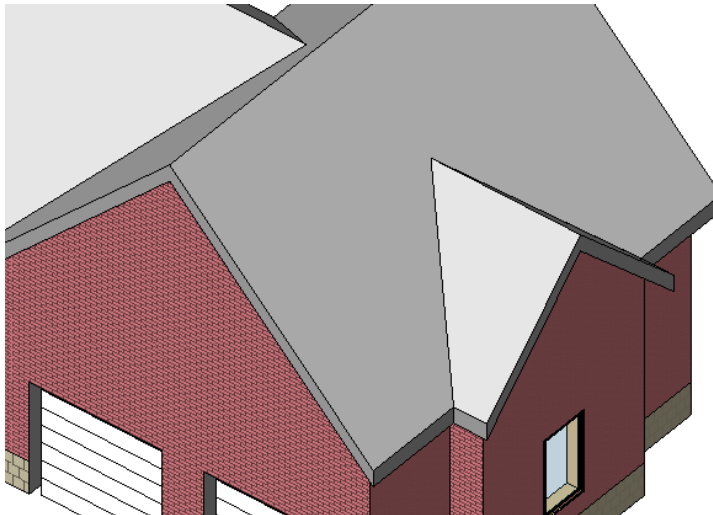
To Join roofs, obtain a 3D view in which you can see an edge on the minor roof to be joined and a face defining edge on the adjacent major roof. From the Geometry panel on the Modify tab of the Ribbon, pick Join Roofs, Pick a vertical edge on the minor roof and then pick the edge of an adjacent roof face. Easy as 1, 2, 3. 😊

The Join Roofs command cannot be applied to walls. Use the attach option for walls. The Unjoin Roofs tool lets you reverse a Join roofs operation. Just pick the tool and pick one of the joined edges where the minor roof meets the major roof face. It is possible to join a roof to the top face of an adjacent roof and the wall below if you select the wall as the "attach to" target. This will only work if the target wall is already attached to a footprint type roof above.

If you want walls to extend up to a roof or to trim off where they protrude through a roof, select the walls and on the options bar pick Attach and then select the roof. When a wall is attached to a roof, it will change height automatically if the roof is modified or repositioned.



After attaching a wall to a roof, you can use the Detach option to return it to its original height. In some instances, attaching a wall to a roof will not yield the desired result, especially around short jogs in gable walls. In these instances you may need to edit the wall profile manually to obtain the desired results.



Detach the wall from the roof or just pick the wall and choose Edit Profile to automatically remove all attachments while you modify the shape of the wall in an elevation view.

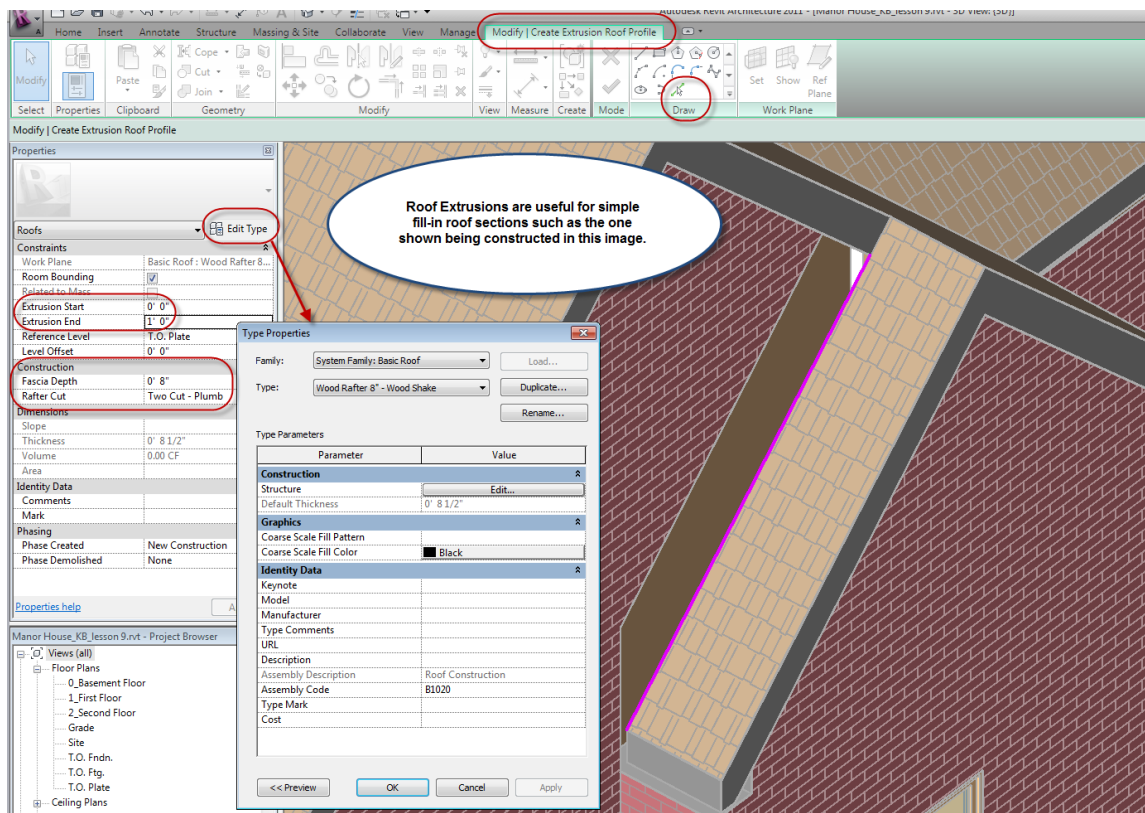
3. Extruding Roofs, and Adding Dormers

Roof Extrusions allow you to define a roof with an open curve of lines and/or arc segments.

Extruded Roofs support the same compound structure available in footprint roofs.

The open profile will define the top edge of the roof and the extrusion properties will let you define the depth.

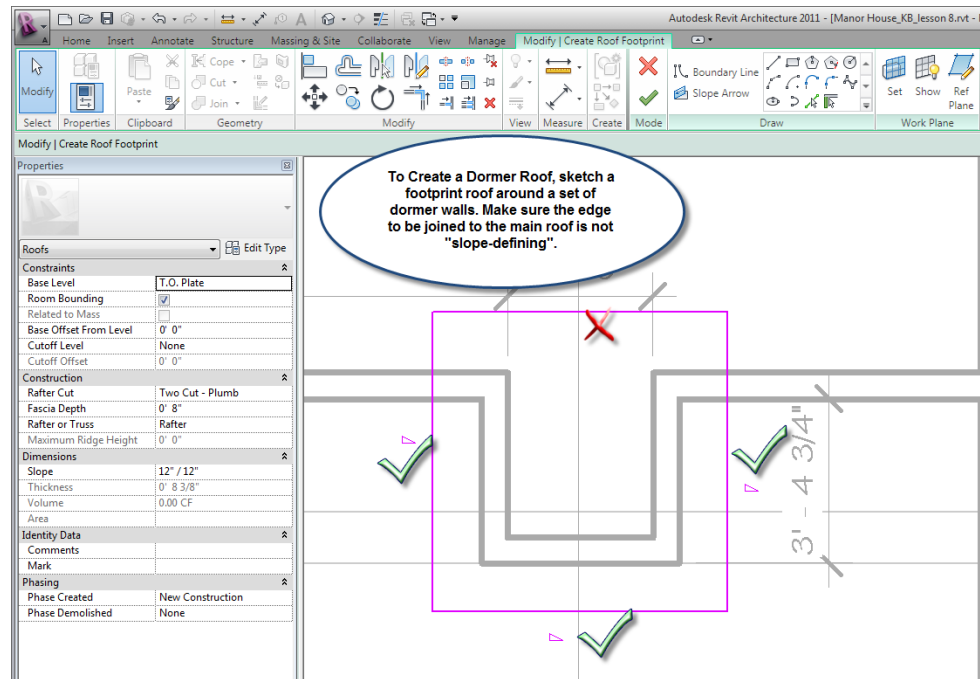
Extruded Roofs allow you to create simple dormer roofs, arch dormers, eyebrow dormers as well as sections of roof fill pieces for things like gable returns.



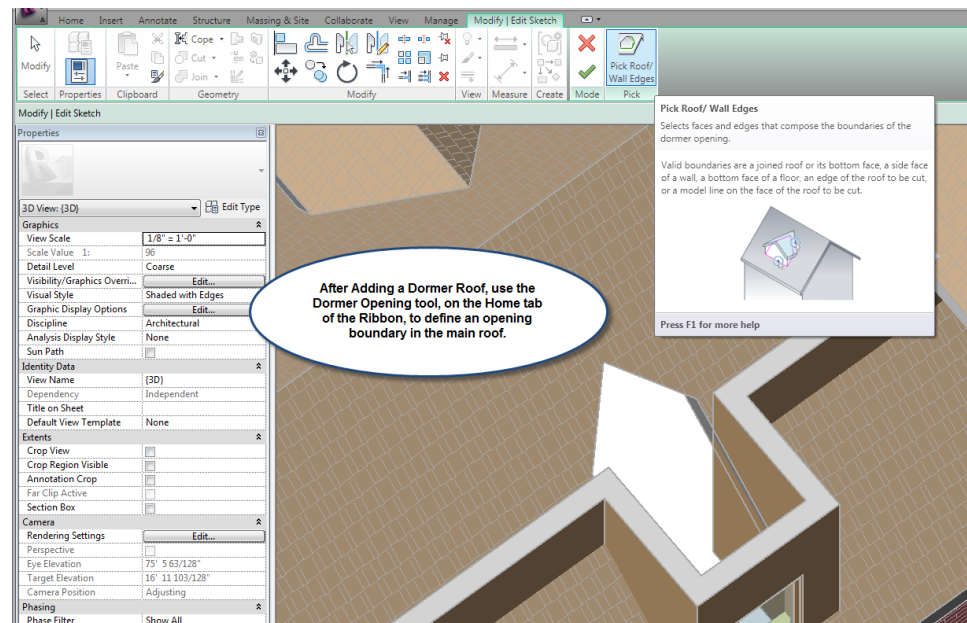
When you choose the Roof by Extrusion option, you will be prompted to define a work plane in which to draw the sketch. This plane will also set the start location for the extrusion.

If you don't specify the extrusion depth, Revit will estimate the depth for you based on the size of the project extents and the size of the sketch.

To create a Dormer roof, you create a small roof, usually over a set of dormer walls and then join the dormer roof to the main roof. Dormer openings can be created by sketching a closed loop inside the perimeter of the main roof sketch or with the Dormer Opening tool. You can sketch the footprint by picking walls on three sides and then adding the back edge with a line.



After defining the Dormer roof, you also need to cut a Dormer opening in the main roof. Openings may be created in a plan view or elevation view where you can see the main roof face as well as the dormer roof shape and dormer walls.



The final step in the creation of a Dormer will be to edit the profiles for the sidewalls of the dormer to close the small openings below the roof.

Exercise Notes

In the following exercise we will continue to develop the Manor House project, adding two main roof sections on the first and second floors, a small roof over the laundry room and two dormer roofs in the Den over the Porte Cochere.

1. Open the Manor House project and switch to the View tab. Create a new floor plan view which references the Top of Plate 2. level. Make this level current and rename the plan view to 03_Roof Plan but do not rename the level. The second floor walls should be visible as an underlay. The interior walls over the garage and Porte Cochere should be in place for this exercise.
2. From the Build panel on the Ribbon, choose Roof / By Footprint. On the options bar set the Overhang to 1'-4" and confirm that Defines Slope is selected. Move your cursor over one of the main second story exterior walls and press Tab to highlight the entire chain of walls. Pick the wall to create a full perimeter sketch in one step. If necessary, add lines or trim corners to create closed boundary
3. Pick the Edit Type button on the Properties Palette. In the Type pulldown, select the Wood Rafter 8" – Asphalt Shingle – Insulated type. Choose Duplicate and call the new type Wood Truss 6" – Wood Shake. Pick Ok and then pick the Edit button by structure to open the Edit Assembly dialog. In layer 4, change the Material to Structure Wood Joist / Rafter and set the thickness to 5 1/2". In Layer 1 change the Material to Roofing – Wood Shake and set the thickness to 5/8". Leave the Substrate layer as 5/8" plywood sheathing and pick OK. Pick OK again to finish creating the new roof type.
4. The current roof slope as indicated by selecting a sketch edge is 9/12. Let's change this to 12/12. In the Dimensions section of the Properties Palette, set the Slope to 12/12. Confirm the base elevation is Top of Plate 2. and the base offset is 0". Leave the rafter cut at Plumb Cut and the Rafter or Truss set to Truss. Pick the checkmark on the ribbon to finish the sketch.
5. Pick Finish Sketch and if prompted to attach the selected walls to the roof, pick NO. We do want the exterior walls to be connected to the roof but not the interior walls. Switch to a 3D View and take a look at the Hip roof we have just created.

6. We need to make two, gable sections at the front walls of the house. It is possible to edit a roof sketch in a 3D view as well as a plan view. Switch to a Southwest isometric view and zoom in on the hip roof faces at the very front of the house.
7. Select the roof and from the Ribbon choose Edit Footprint to switch into Sketch mode. Pick one of the front edges going from East to West and on the Options bar, clear the check mark by Defines slope. Pick the next horizontal edge where we want a gable roof, right click and choose Toggle Slope Defining from the cursor menu. Pick Finish Sketch.
8. Choose No if prompted to attach the walls to the roof automatically. For a simple gable roof, this is where we would like to attach the wall to the roof. Float your cursor over one of the exterior walls and when it highlights, press TAB to select the entire chain. Pick to select all of the walls in the chain, and from the Modify Wall panel on the Ribbon, pick Attach Top/Base. Pick the roof and if prompted to remove a reference dimension, pick yes. The Gable ends do fill in but the result will need to be modified by editing the wall profile in the next class. Hit CTRL-Z to undo the operation.
9. Switch to the South elevation view. When you're creating a roof, it is a good idea to look at in the elevation views, especially the Front elevation, so you can get a read on what the roofline is going to look like and also how tall the roof is getting.
10. Zoom in on the eaves at the right side of the roof. Draw a dimension from the top edge to the bottom edge of the vertical eaves section. The fascia depth is about 9 1/2". Delete the dimension.
11. Zoom out and then zoom back in to the eaves at the left side of the roof where you can see the shape of the end of the angled member. Move your mouse over the roof until it highlights and then pick the roof. Pick Element Properties and set the Rafter Cut to Plumb Two Cut and the Fascia depth to 6". Pick OK. Go back to the right side of the roof and redraw the dimension you created in step 10 to confirm it is now 6" as specified.
12. Zoom back out to where you can see the entire roof. It is very high at the main ridge. If you draw a dimension from grade to the peak you'll see it is over 41 feet tall. Pick the roof and in the Properties Palette change the Slope to 6/12 and pick OK.

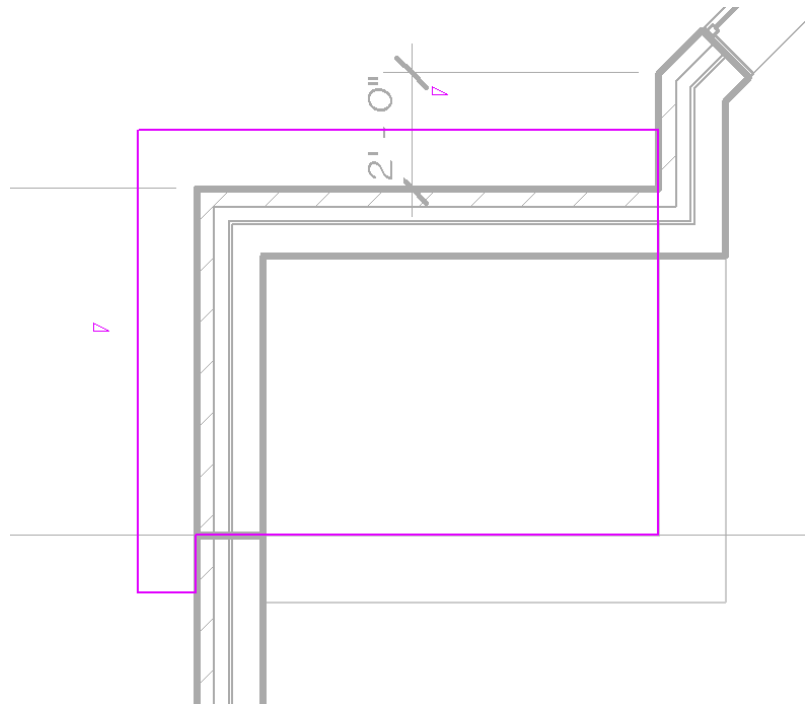
13. AGGGHHH! It looks terrible to have a low pitch on such a grand house. Change the slope to 9/12 and check it again. If you draw a dim from grade to peak you see it is just over 36 feet which is more reasonable but it would look better with the steep pitches on the side. The solution is to drop the slope on the back face of the roof where the lower angle will only be visible in a side elevation.
14. Set the slope for the roof back to 12/12. Switch to the Roof Plan view. Pick the Roof and on the Ribbon pick Edit Footprint to go back into sketch mode. Pick the horizontal line to the right of the bay section at the back of the house. Pick the slope indicator which is showing 12/12 and change the value to 8/12. Repeat for the corresponding horizontal section to the left side of the bay.
15. When we adjust the slope on selected faces of a roof to create a multi-slope roof, we need to align the eaves before finishing the sketch. Otherwise it may not be possible to create the roof. From the Sketch bar, pick the Align Eaves tool and Adjust Overhang. A number of leaders and distances will be displayed showing the current eaves height. If you zoom in to the back of the roof you can see that the eaves height for the two sections we just modified is now -1'-0" instead of -1'-4". Even if the roof can be created, the eaves height will vary by 4 inches in this area. Pick one of the roof segments with the -1'-4" eaves height and then pick the two segments with the -1'-0" eaves height. The overhang distance increases and the eaves should now align. Pick finish roof and if any dims are reported as invalid, remove the references.
16. Switch back to the South Elevation and check the height of the roof above grade. 39 feet is the allowable roof height for this area, so at 38'-3", we can keep the new configuration.
17. Switch to a 3D view and change your viewing direction until you can see the back corner where we dropped the walls to the first story around the laundry room. If the walls in this area are extending up to the roof, select them and choose Detach Top/ Base.
18. Switch to the Second Floor view and zoom in around the laundry room. Make sure your underlay setting in the View Properties dialog is set to display the first floor walls.
19. From the Build panel, choose Roof / By Footprint. Set the overhang to 1'0" and the slope of the roof to 12/12 so it matches the pitch on the main roof. Set the Base Level to Top of Plate 1. Set the rafter cut to Two Cut Plumb and the fascia depth to 6".

20. Sketch the roof footprint as shown in the image at right. The return section is 1'-0" long and only the two main lines will define a slope.

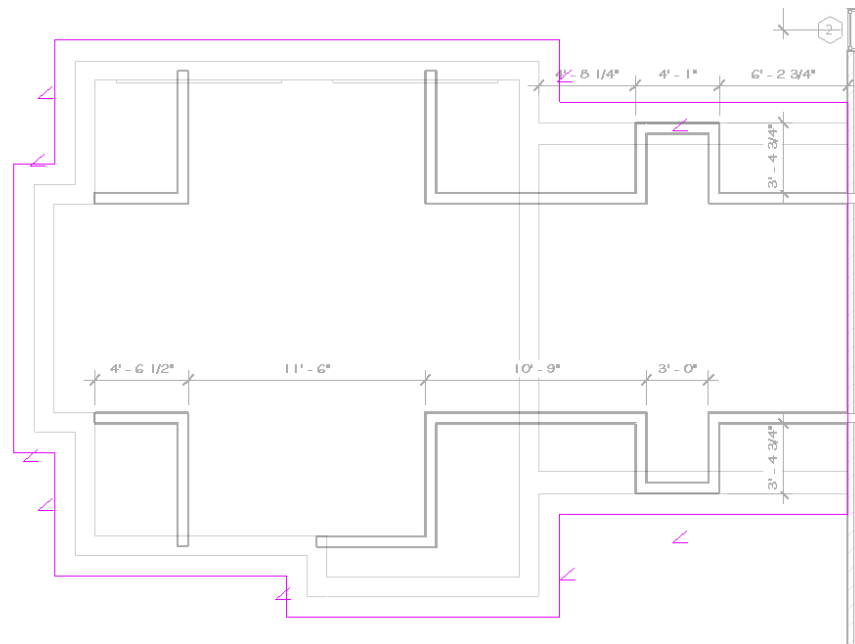
21. Switch to a 3D view and zoom in on the laundry roof. Looking very nice but the roof is bit extensive. Change the slope to 8:12 to lower the roof. That looks better. :) There may be a small notch in the outside wall corner above the roof. We will fix this with an in-place model in an upcoming class.

22. Check the West elevation to see how the roofline looks from the side view. Switch back to the Second Floor view and zoom out over the garage and porte cochere. It is time for the fun part.

23. Creating a roof which will extend up from the first floor and encompass a living space on the second floor, within the roof confines is always a tricky proposition but Revit can make the process easy. After creating the roof and letting it cut through the walls you can create section views to help you check ceiling heights and available headroom and get a look at the space you are proposing, from the inside out. Turning a section view into a 3D section also allows you to examine the connections from any viewing direction.

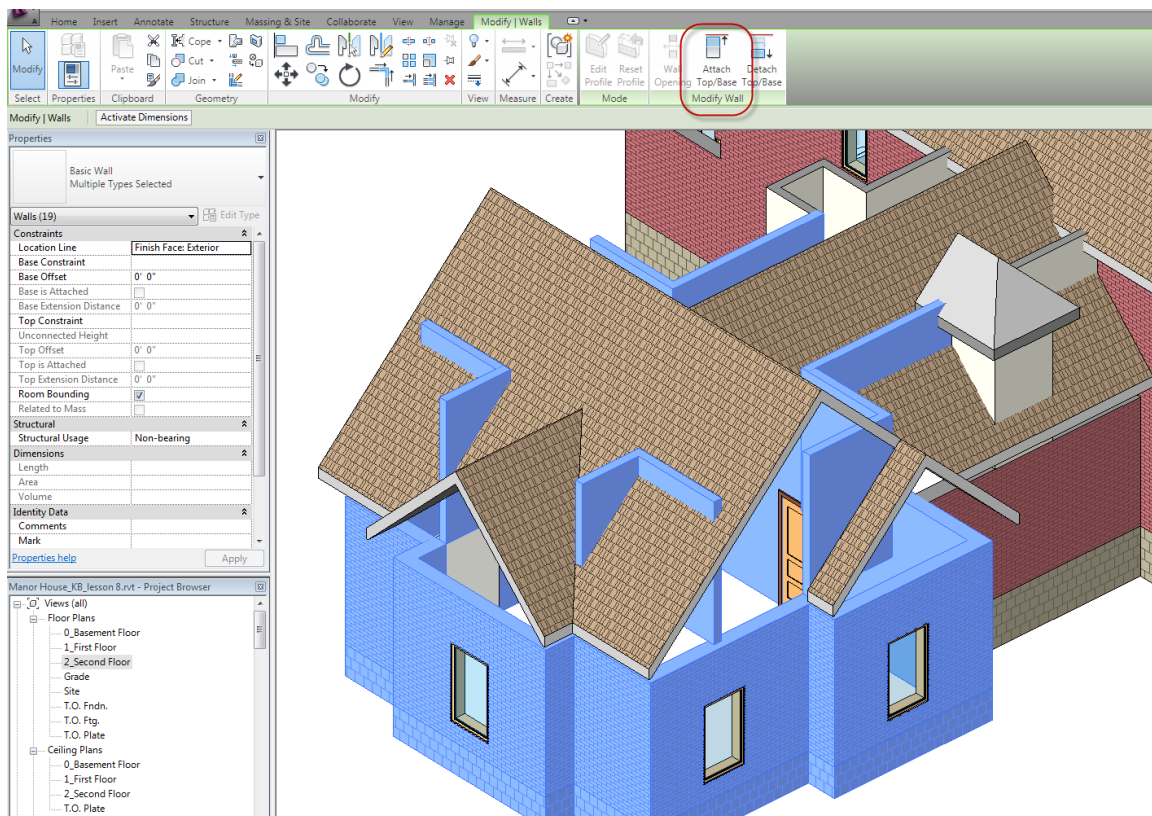


24. Create a Roof by Footprint which encompasses the walls of the garage and the porte cochere and attaches to the wall of the main house. If you do a chain selection for the garage, you can split the sketch line on the right side and connect it to two lines drawn 1' 4" from the Porte cochere walls. Use dimensions to help place the lines you draw if required.
25. Add one more line along the brick wall of the house to close the loop. Turn off the slope defining for the line against the house. There will be four gable sections on the garage. Toggle the slope defining off for the edges as shown below.



26. Open Roof Type Properties and Duplicate the Wood Truss type. Create a new type called Wood Rafter 8" – Insulated – Wood Shake. Edit the assembly to change the thickness of the rafter to 7 1/4" and change the material to match the name. Pick Ok.

27. Set the Base level to 2nd floor and the base offset from level to 2'-0". Set the Rafter Cut to Two-Cut Plumb and the Fascia depth to 6". Set the slope to 12"/12". Pick Finish Roof and if prompted, say no when prompted to attach the walls to the roof. We'll pick the ones we want to attach in another step so we can save the dormer walls. If you get an error instead of an offer to attach walls, examine your sketch and try redrawing any lines that may not be connected properly.
28. Switch to a Southwest isometric view and do a chain select of the exterior garage walls. Press CTRL and add the interior walls on the second floor over as far as the dormers. From the Ribbon bar, choose Attach and then pick the new roof. *You will get a warning about overlapping walls caused by the first floor exterior wall overlapping the interior partition above. Accept the warning and continue.*



29. Select the 6 dormer walls plus the 4 adjacent walls connecting to the dormer walls. Set their top offset to -2'-0" to lower them to a 7 foot height.

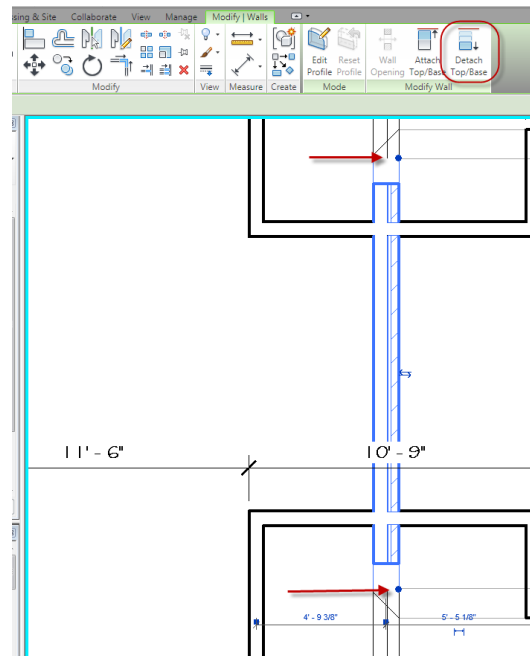
30. Switch to a second floor view and we can see the most serious problem where a wall from the first floor has now attached to the roof and is cutting through the entrance to the guest suite. Use the split tool to break this wall into three segments. Pick the middle segment as shown at right and choose Detach and then Detach all from the Options Bar.

31. Switch to the 03_Roof Plan. view and zoom in over the dormer at the front of the house. Pick the roof over the porte cochere and from the view control bar choose Hide Element.

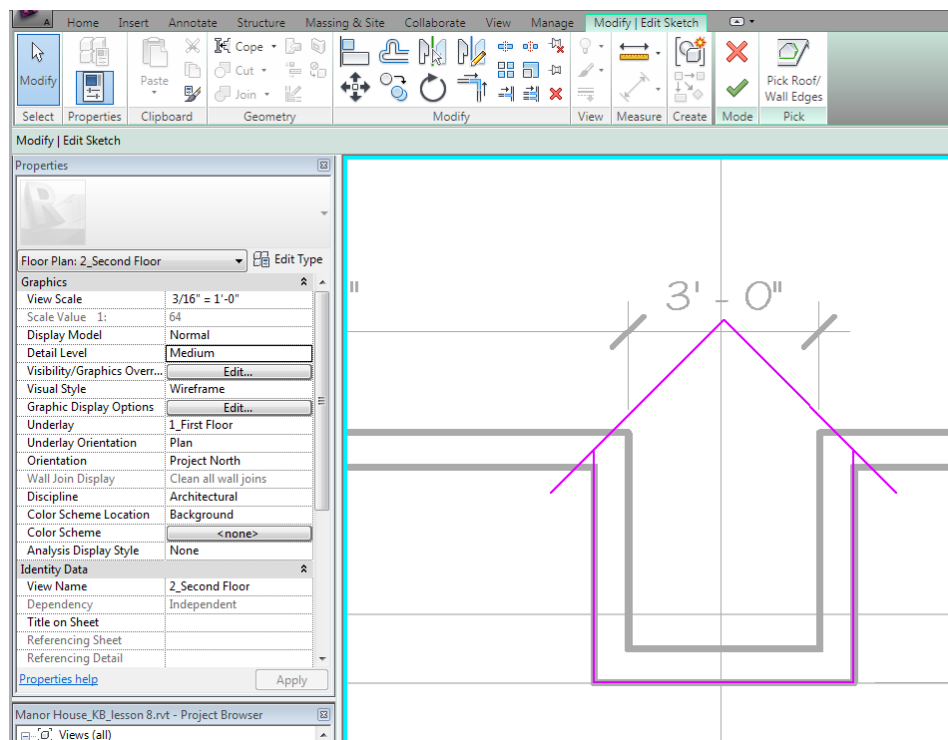
32. Create a new wall type by duplicating the 6 ½" partition and editing the structure to change the gypsum wall board on exterior to ½" on ½" plywood sheathing. Assign to all 6 dormer walls.

33. Create a Roof / By Footprint with a 6" overhang and a 12"/12" slope around the dormer walls. Set the Roof properties so the Base Level is at 2nd Flr. Clg. and the Base Offset is set to -2'-0". Set the Rafter Cut to Two Cut and the Fascia depth to 6". Pick OK and then Finish Sketch to create the roof.

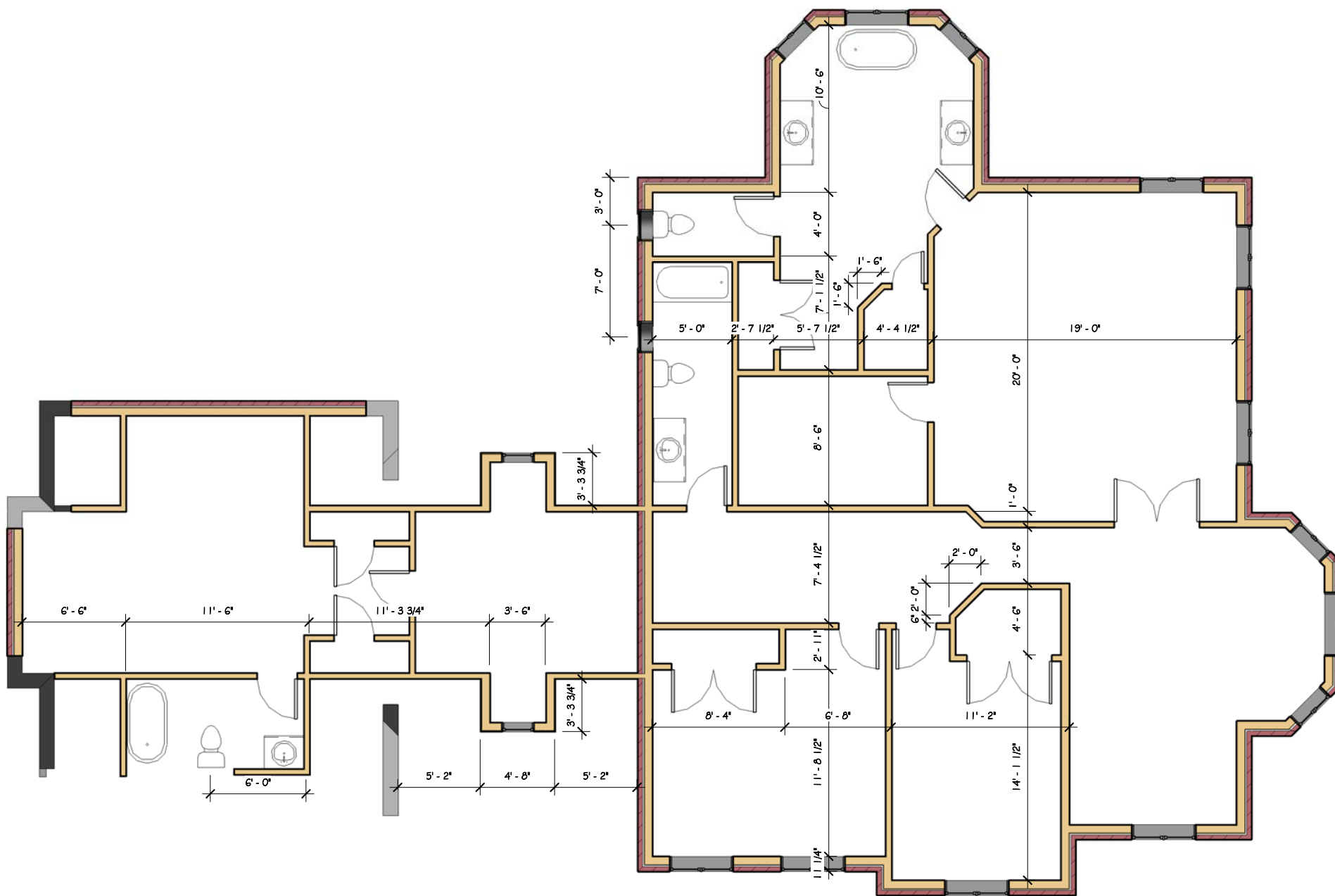
34. Switch to a3D view and zoom in to where you can see the dormer roof next to the main garage roof. Pick the Join Roofs tool and then pick an edge at the back of the dormer. Pick another edge along the adjacent, main roof face.

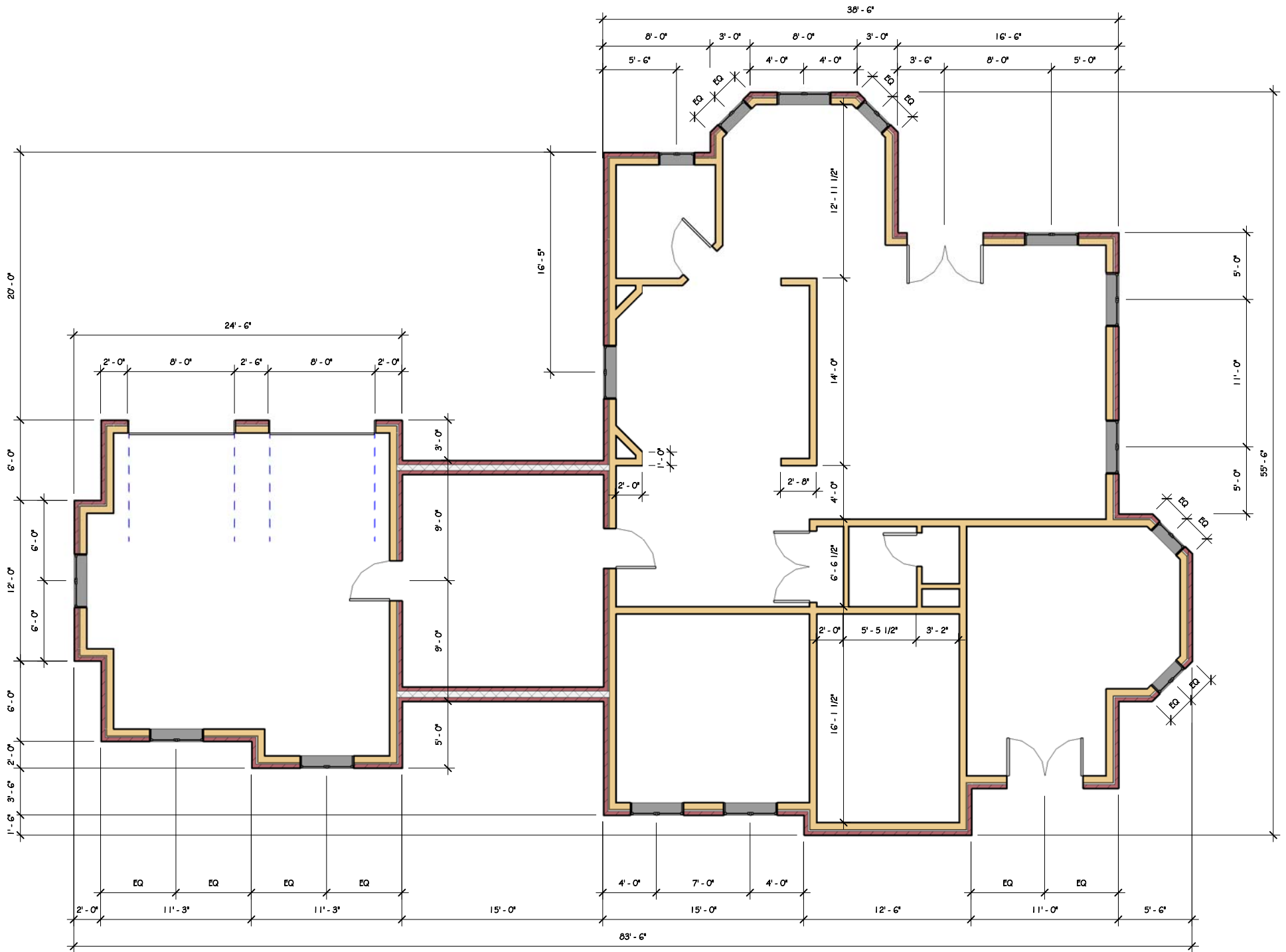


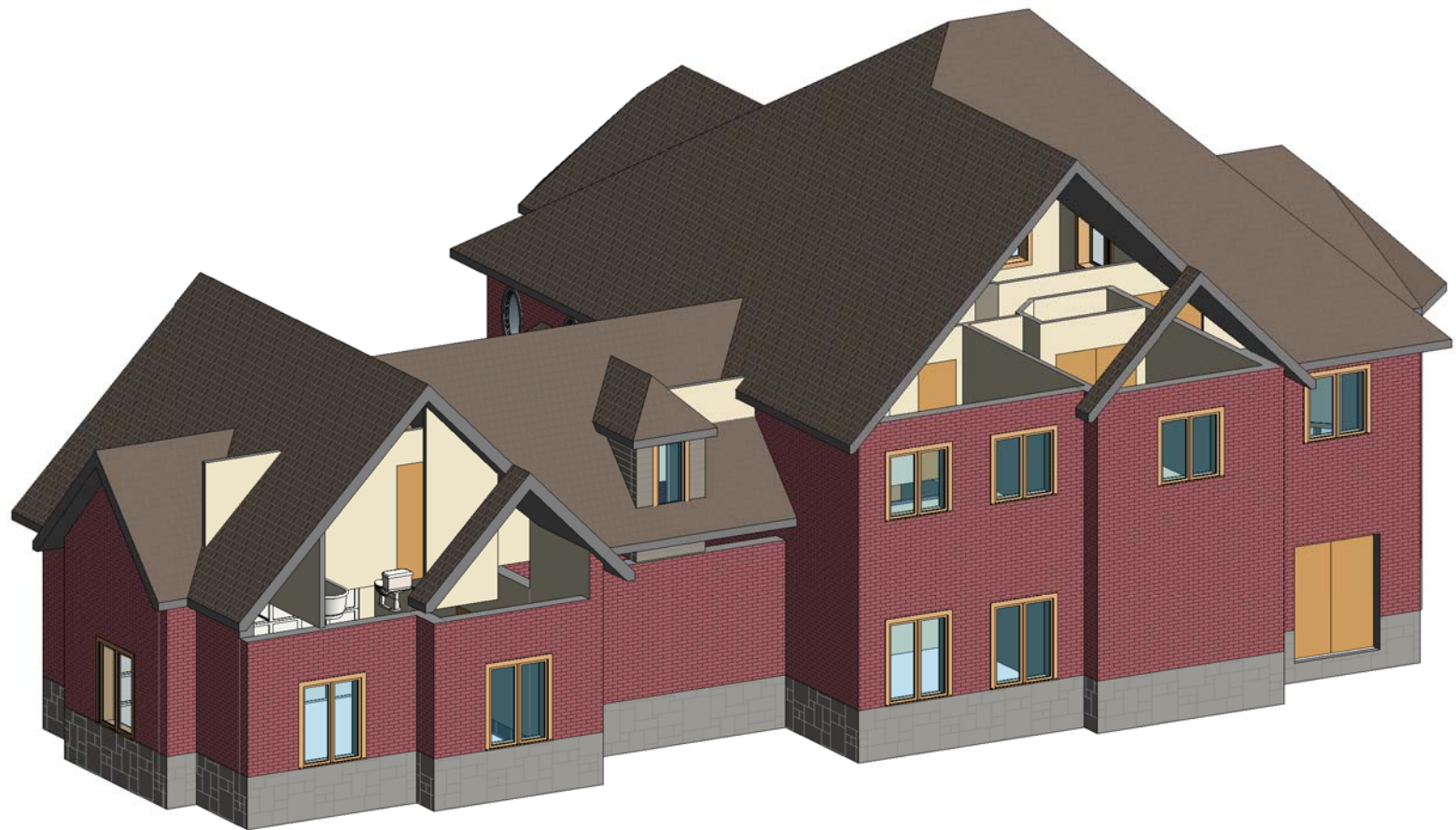
35. We need to make a cut in the roof where we can access the dormer. From the Architecture tab on the Ribbon, choose Opening / Dormer Opening. Pick the main roof and then pick the dormer roof to start the sketch where the two roofs intersect. Switch to the second floor plan view, and pick the dormer walls to add three more segments. Drag their endpoints or use Trim to clean up the corners of the sketch. The sketch lines along the roof can overhang the parallel edges in this type of sketch as shown below, or you can trim the corners to form a closed loop. Choose Finish Boundary to complete the dormer opening.



36. Switch to a 3D view and use the temporary hide control to hide the dormer roof so you can examine the cut. Repeat Steps 30 to 35 to add the second dormer roof and dormer opening.
37. Save and close the project. We will continue to develop the roof and wall elements and connections in the next class.







AGENDA:

1. Editing Wall Profiles
2. Joining and Cutting Geometry
3. Adding Wall Openings
4. Hosted Sweeps for Walls and Roofs

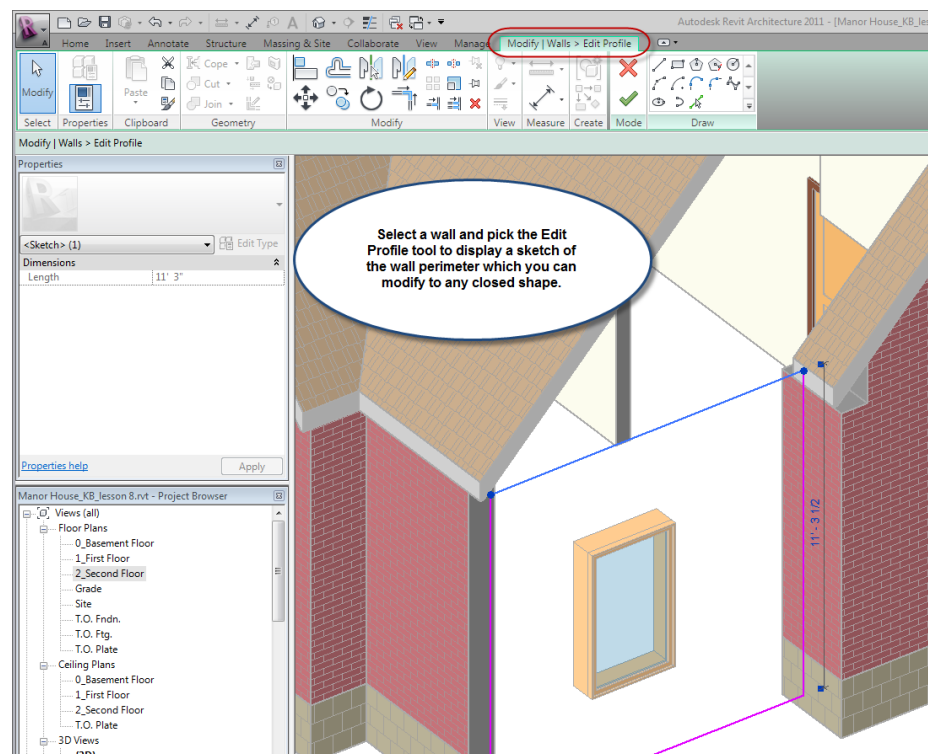
1. Editing Wall Profiles

Revit allows you to customize the shape of a wall by editing the profile. This lets you sketch curved or even circular wall objects and fine-tune the shape of a wall to accommodate steps, jogs, or angled edges anywhere around its perimeter.

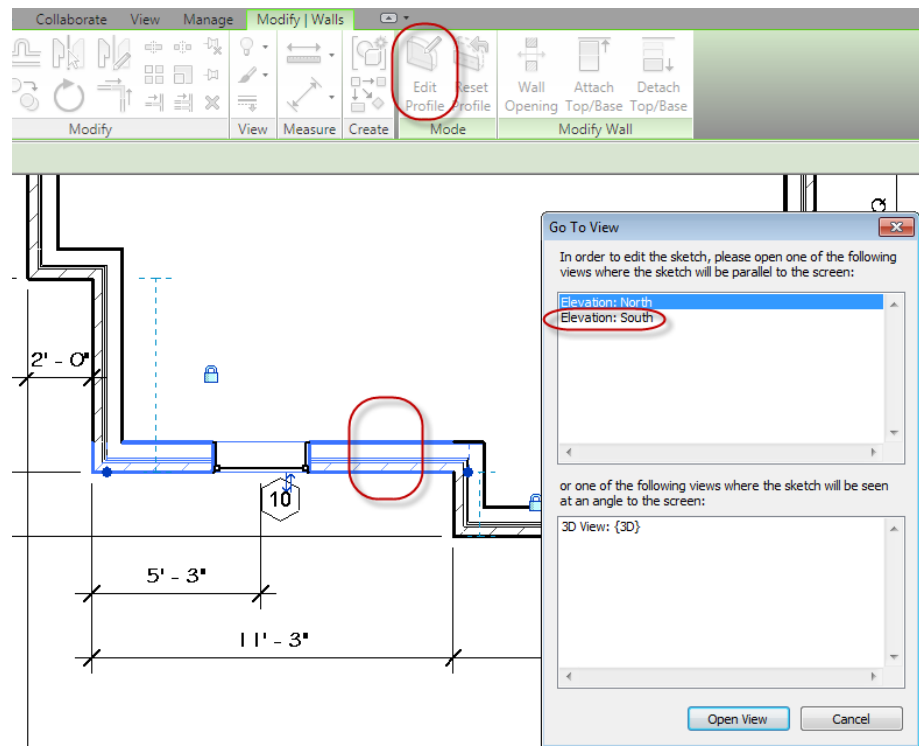
If you select a wall and choose Edit Profile from the Ribbon, you will be placed in Sketch mode and the existing wall shape will be displayed as a rectangular sketch.

When you edit the profile of a wall, any attachments to the top or the base of the wall will be removed while you edit the profile. When you finish the sketch, depending on the edits you have made, the previous attachments may be permanently discarded.

To revert a sketched wall profile to its original shape, pick the wall and from the Options Bar, choose Reset Profile.

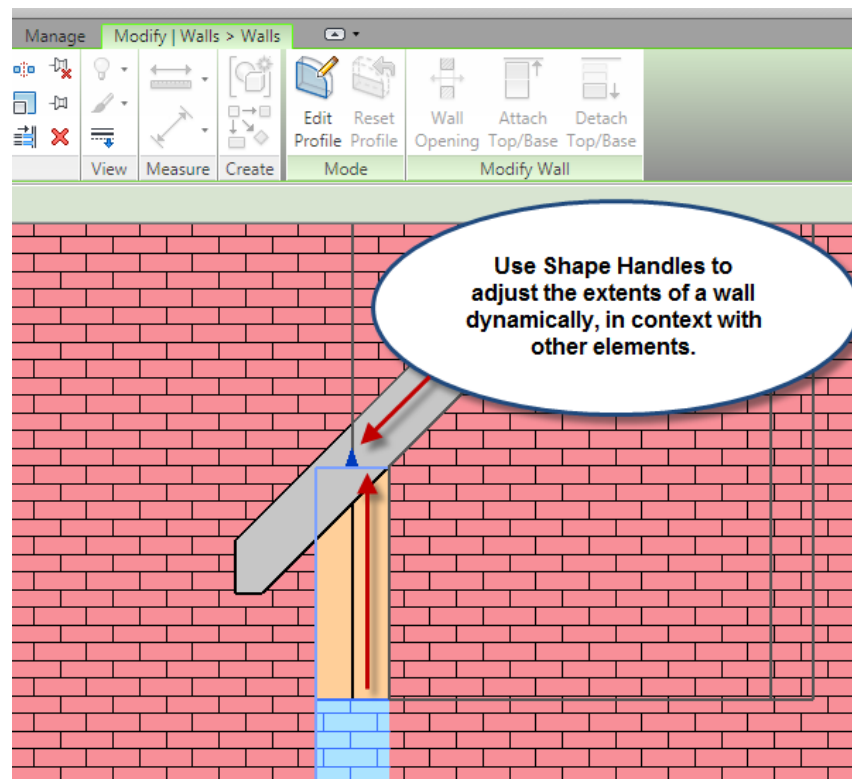


Editing a wall profile is best done in an elevation view. If you start the process in a 3D view when you select the wall, switch to the appropriate elevation view to perform the edit. If you select a wall in a plan view and choose the Edit Profile option, a Go to View dialog will appear allowing you to choose an appropriate view in which you will be able to edit



the sketch. In the example shown here, since the selected wall is on the South side of the building, I would choose the South Elevation as the best choice to display the most complete context.

Wall shape handles appear at the default top and bottom elevations for a wall. Selecting the shape handle allows you to drag the top or bottom of the wall up or down, dynamically modifying the height or base elevation offset.

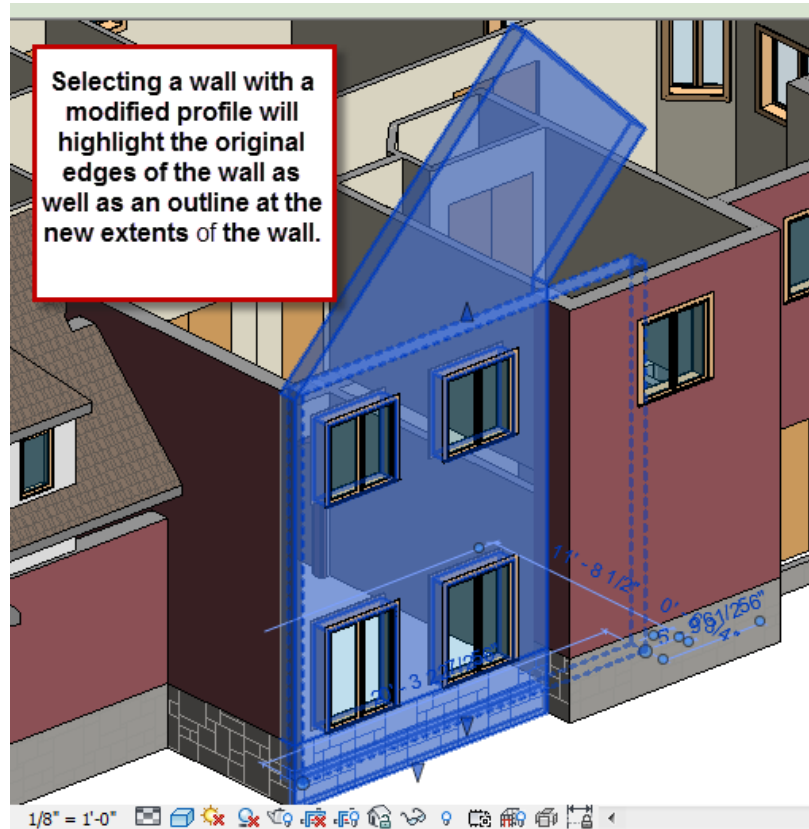


Walls that have had their profile edited will display extra edges and outlines in all views. The overall extents of the wall will be shown with additional shape handles in an elevation view, a blue dashed line in a plan view, and as a blue dashed outline in a 3D view.

While editing the shape of a wall profile, you can use the Pick edges tool to copy lines from existing building elements around the wall being edited. When you pick edges you can optionally lock the sketch line to the picked element so the wall profile will update if the adjacent elements are moved or reshaped.

You can also create dimensions and use the Align tool while sketching a wall profile to create additional constraints.

Use the control grips at the ends of wall sketch segments to drag and reshape the sketch.



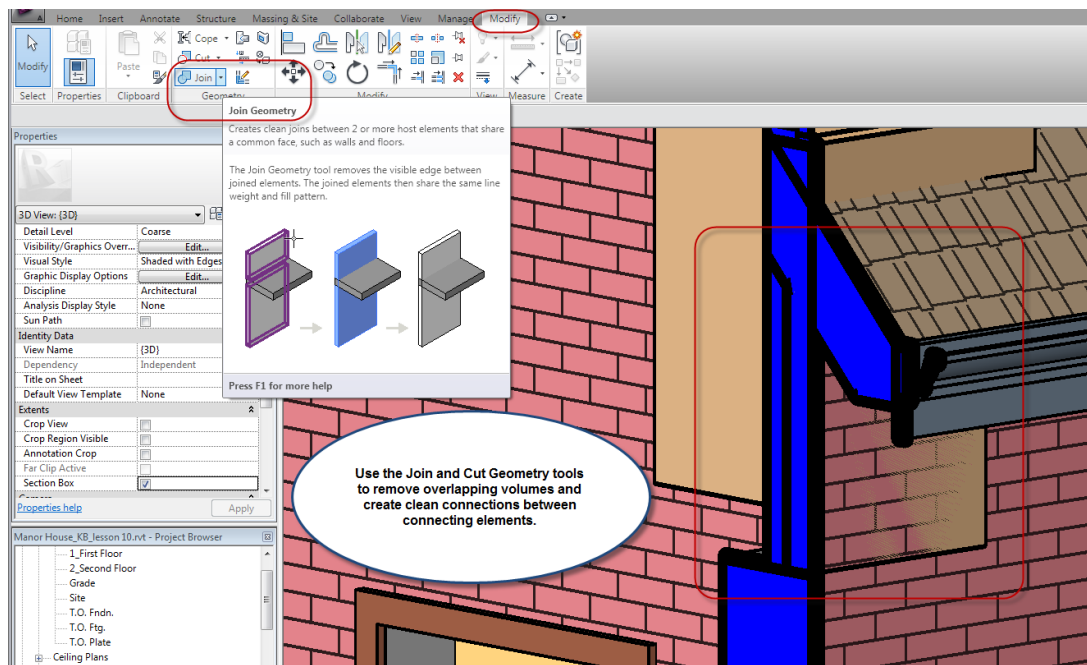
When you drag the endpoint of a closed sketch into an open loop, you may be prompted to delete an existing lock or constraint. You can safely ignore this message as you will be adding new segments to close the loop.

If the edit profile attempt fails, examine the sketch and ensure you have clean connections at all corners with no openings and no overlaps. Nested loops inside the outer loop will define holes in the wall.

Checking how walls connect in a plan view may also aid in trouble-shooting wall profile editing issues. Adjust wall joins if necessary to ensure the end of an adjacent wall is not interfering with the profile you are editing.

2. Joining and Cutting Geometry

The Join Geometry tool lets you create a clean connection between 2 or more host elements that share a common face. This tool also allows you to join hosts and in-place families. You can also use the Cut tool, which although primarily intended for use with modeling geometry in the Family Editor, may also be used to embed one wall in another.

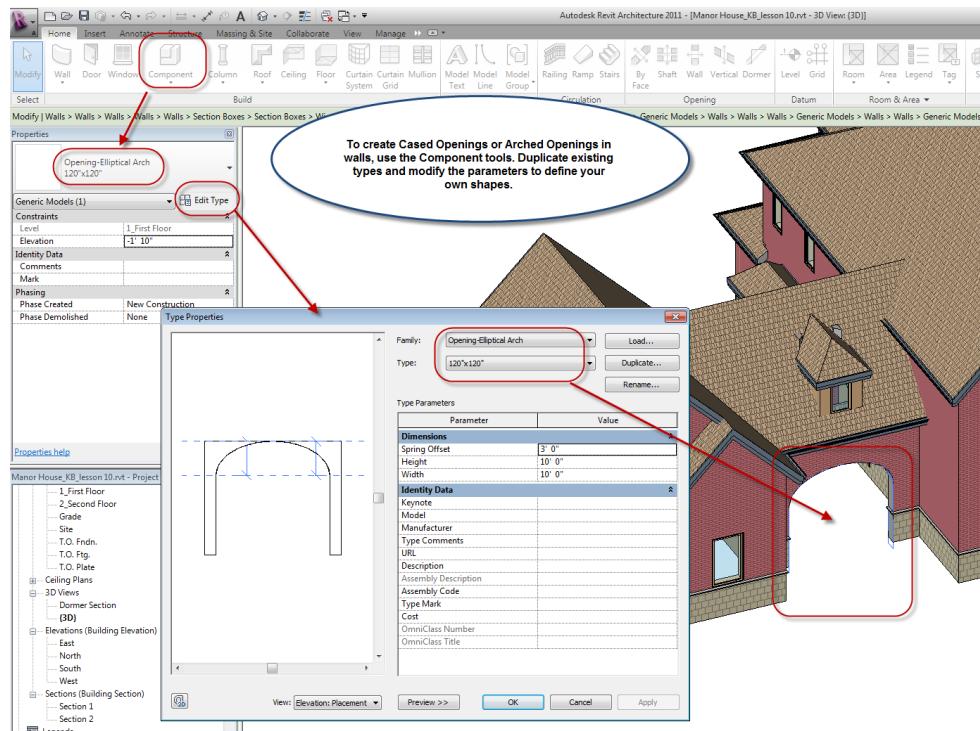


Joining Geometry in the Family Editor environment will create a union between two different shapes or volumes. In a regular project environment, one of the joined elements will cut the other volume, removing the overlapping portion.

When you join geometry in a project, floors, ceilings and roofs will always cut walls. Walls will cut columns and structural elements will cut host elements such as walls, roofs, etc. When you join two walls, the order that you select the elements will determine which will be cut by the other. The first object that you pick is going to stay the same and cut a hole in the second selection. In the image above, if I want the brick component to cut away the bottom of the frame wall where it is showing through the brick, I will pick the main brick wall first. If I join the wall to the roof, the overlapping lines at the sectioned area will be removed with the roof cutting the wall regardless of the selection order.

3. Wall Openings

Openings may be created in walls a number of different ways. Doors and Windows, of course, cut openings in walls automatically. They will be moved along with their host element and will be deleted automatically if the door or window is removed.

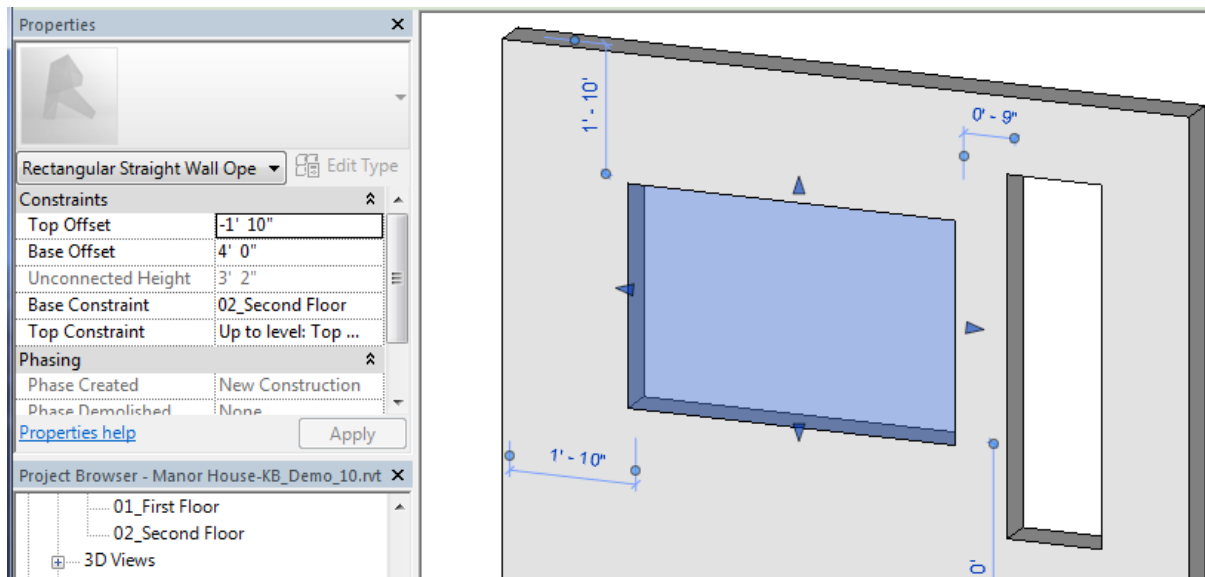


To create openings such as interior arches or cased openings that do not include doors, you can insert a special type of component family defined with a void extrusion and typically called `Opening_Shape`.

Various opening families are available to define standard flat openings, with or without trim elements included. The complexity of the opening is dependent on the component family. Duplicate an opening and set the dimension and shape parameters included with that family to create any required size or variation that the family parameters support.

Component openings usually include plan view symbolic lines as are typically depicted on architectural drawings. Openings in walls usually show the outline of the opening with hidden lines to indicate the overhead edges.

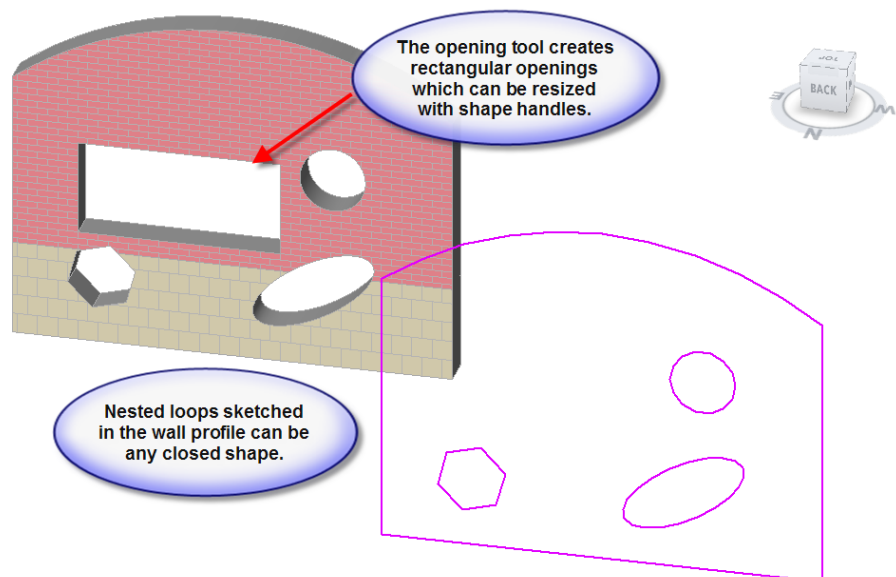
A second way to create openings in a wall is to use the Opening tool on the Architecture tab of the Ribbon. This is the same tool that is used to create Dormers. When you select the Wall Opening tool you specify the start and end point of the opening. It may be drawn in an elevation view where you can see the scope of the opening or in a plan view where you can choose the start and end point of the opening and then specify the top and bottom locations via the element properties dialog box.



To lock a wall opening's size or position in the wall, add dimensions and lock them.

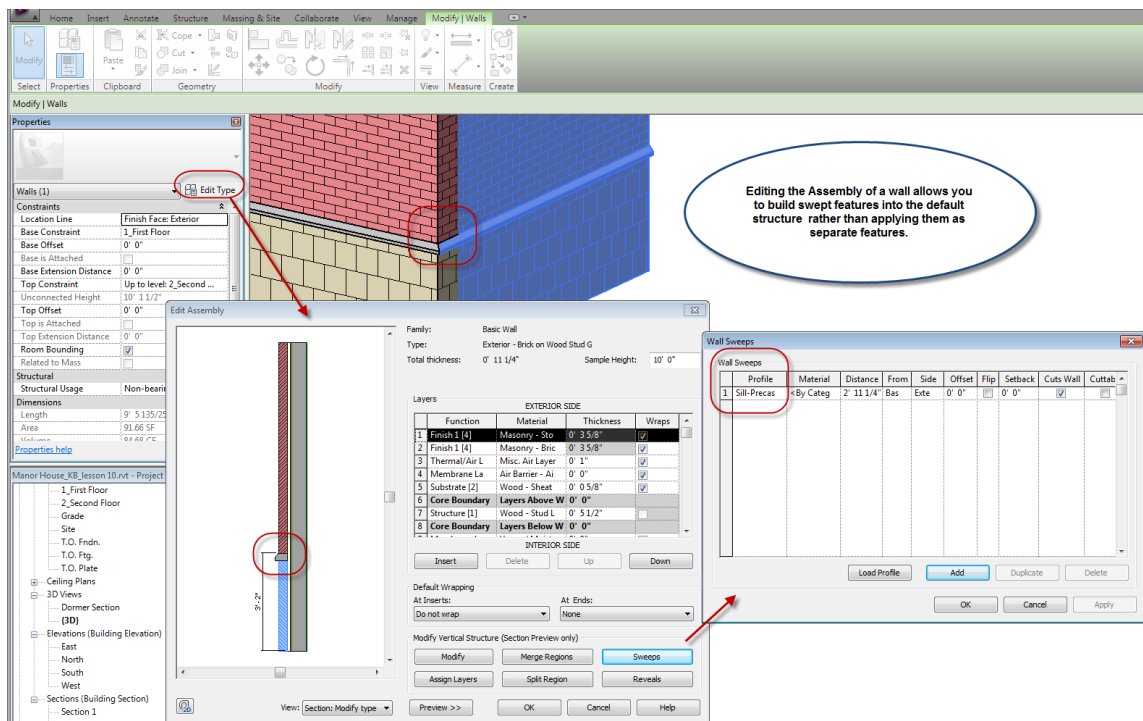
You can create detail lines or reference planes to assist in positioning the opening if desired.

To create non-rectangular openings in a wall, edit the Wall Profile and draw closed shapes inside the outer perimeter. Any closed, nested loop will produce a hole in the wall.



4. Hosted Sweeps for Walls and Roofs

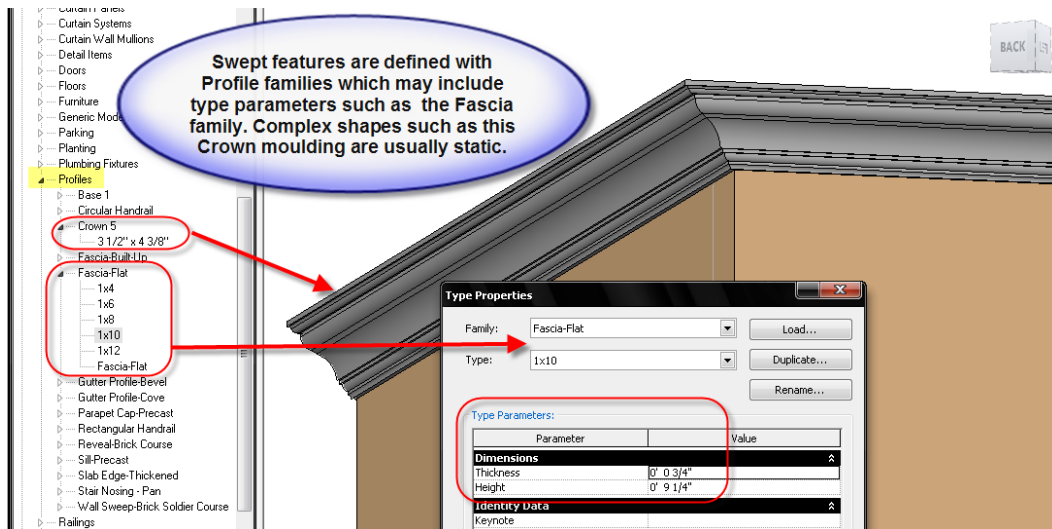
A sweep is a tool for creating an extruded shape that will follow a path. Sweeps may be created with the Family Editor, as In-place families or by using the Hosted Sweep tool from within a Project. Sweeps added to a wall with the Hosted Sweep method can be selected independently of the wall and can be repositioned or modified.



Sweeps may also be defined as a constant feature for an element such as a wall by adding the sweep through editing the assembly of the wall type and opening the Wall Sweeps dialog where you can select a profile, set its material, its location and orientation, and how it reacts to walls and inserts when it intersects them.

Wall sweeps may be set to Cut Walls (recommended) and optionally to be cuttable by inserts such as doors and openings. If a sweep is cuttable, a window frame that intersects the sweep will cut a portion of the sweep away and it is not possible to force the sweep through the insert. If a sweep is not cuttable it will still stop at openings but a control grip will be added to each end of the sweep allowing you to drag it and reposition the end.

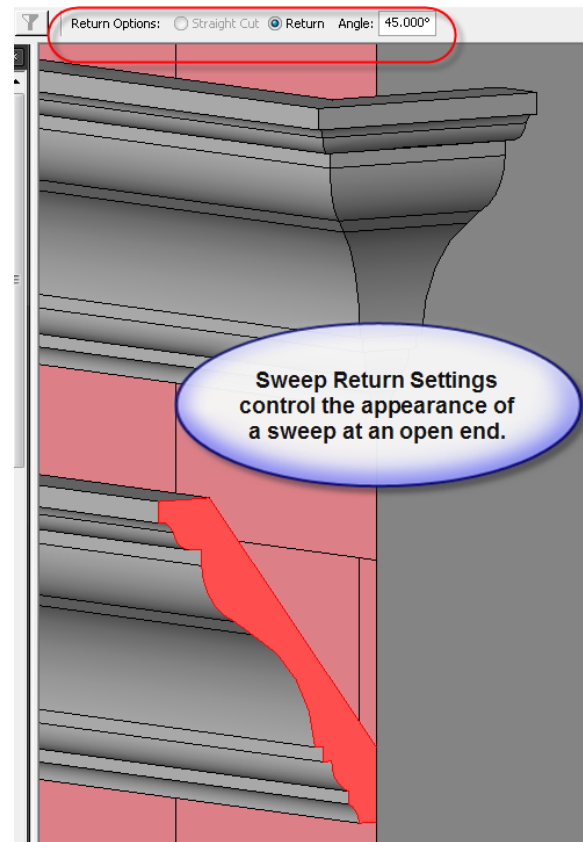
Sweeps rely on Profile families which are created in the family editor from closed loop sketches. Various types may be defined for a single family so you can load a profile and then use several different sizes within the project.



Some Profiles include parameters to control the dimensions of the shape and allow for duplicating and creating your own profile types. Instance parameters for hosted sweeps allow you to set the position and offset for the sweep relative to a base level and the surface of the host. Changes to the actual size or shape of the Sweep are derived entirely from the Profile.

When you add wall sweeps one at a time, they will be created as separate elements. After adding one or more segments to a sweep, if you want to continue the sweep on adjacent walls, modify the sweep and pick add/remove wall segments.

Use Sweep return options to control how a sweep will wrap at an open end.



Wall Reveals are very similar in function and application to Wall Sweeps, but instead of using a profile to add a built up section to the wall, a Reveal uses a profile to remove or cut away a portion of the wall. Reveals are typically created with rectangular profiles using sizes of brick multiples such as 2 courses, rowlock course, or soldier course.



Roof Objects support two varieties of Sweeps to create Fascia and Gutters. Fascia and Gutters may be added to edges of Roofs, Soffits, and other Fascias.

Fascia sweeps may be added in any type of view, but to get the best feel for the result as you are placing the sweeps, use a 3D view. This method will also allow you to orbit the view direction and continue to pick a series of edges all the way around your building.

If you add edges, stop, and then need to continue the Fascia, select the existing section and from the Options bar choose, Add / Remove Segments.

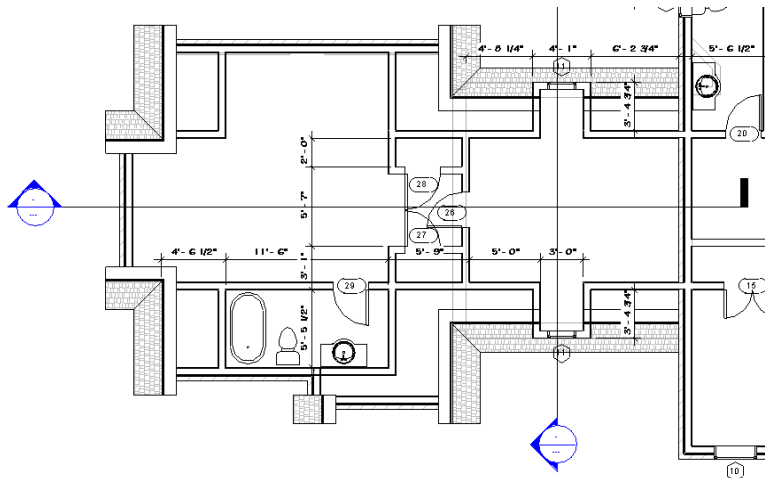
When you add Fascia, you can access the element properties during or after creation and access Vertical and Horizontal offset values which will allow you to shift the entire sweep up and down or in and out from the selected edge.

Fascia and Gutters may be flipped or reversed by selecting the Sweep and Picking the Flip control arrows.

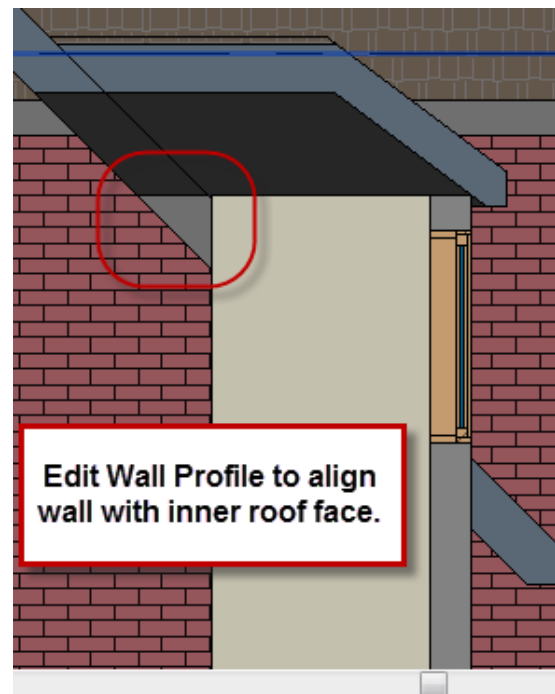
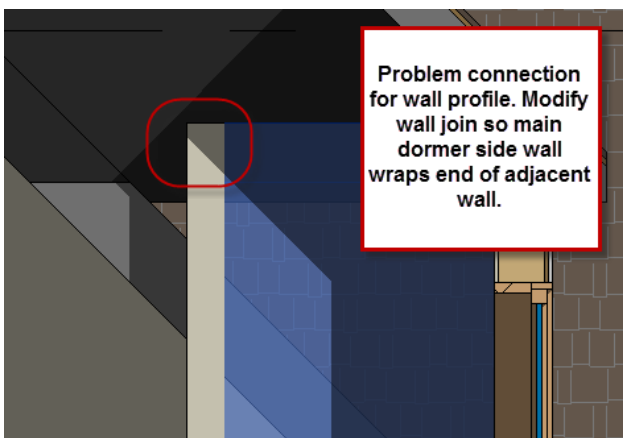
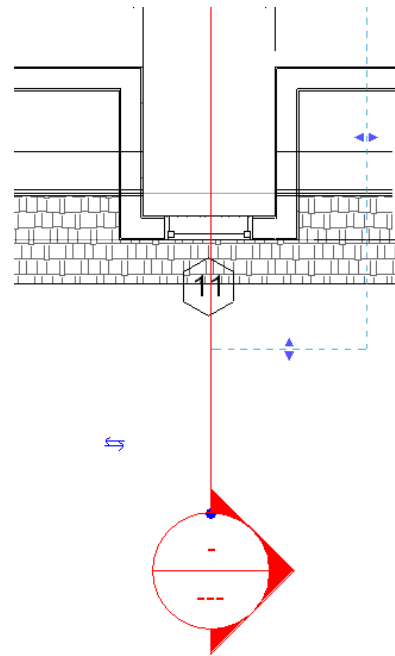
Exercise Notes

In the following exercise you will continue to develop the Manor House project, editing the wall profiles where they meet the roof, adding wall openings and a Bay window projection, modifying wall types to include wall sweeps, and wall extensions, and joining geometry to create clean connections between overlapping elements. Finally, you will add Fascia and Gutter host sweeps to the roof edges.

1. Open the Manor project and set the 3D view current. At this point we have added both dormers and dormer openings to the roof over the den and finished laying out the interior walls for the guest suite. Let's look at how to get a better view of our developing model.
2. Select the roof and from the View Control bar, choose Hide element so you can look down into the space. A floor would help but that will come in the next lesson. For now, orbit the view and try looking into the rooms from different angles. Reset the temporary visibility.
3. Pick the roof and from the Temporary Hide/Isolate tool, choose Isolate Element. Examine the roof from various angles and check your dormer openings to see how they cut through the walls and roof. Switch to the Second Floor view and zoom in over the garage.
4. Split the walls running between the two closets and the two dormers into two separate pieces, with the split occurring at the corner of the closet. The section of wall behind the closet should be attached to the roof. The section of wall next to the dormers should be adjusted with a top offset.
5. Section Views can be very useful to help understand how spaces are fitting together. From the Quick Access Toolbar, choose the Section tool and draw two section lines as shown at right, through the den and guest suite area we have been working on. Draw the horizontal one first.

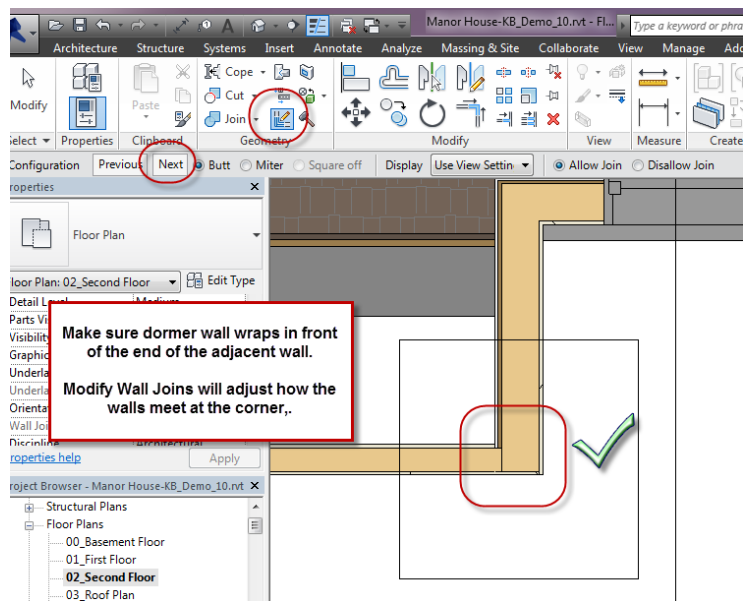


6. Float your cursor over the blue section head for the horizontal section line and when it highlights, double-click to go to the section view. Type SD to shade the display. Turn the Shadow display on just for fun. If your computer starts to slow down, disable shadows.
7. Switch back to the Second floor view. Pick the section line and use the Flip arrows to reverse the direction so it is looking toward the front of the building. Double-click the section head again to switch to the new section view to the South. In this view you should see the second section line cutting through a dormer and extending above the roof. Double click the section head on this section line to switch to its linked view. Shade the view and optionally turn on shadows to see how they enhance the sense of depth in the section.
8. Switch back to the second floor view again. Select the section line through the dormer and reduce its extents as shown. Double-click the Section head to switch to the section view.



9. In the section view you can easily see that the wall does not align with the inner face of the roof. One solution is to edit the wall profile.

10. Select the dormer wall and on the Ribbon choose Edit Profile. Pick Ok to accept the warning about losing our top and base attachments temporarily. Use the Pick Lines tool and select the inner angled line of the roof face. Use Trim to Corner twice to create a closed profile sketch. Pick Finish Sketch. If you have trouble getting the profile to align correctly and display a smooth face when you finish, check the wall joins in a second

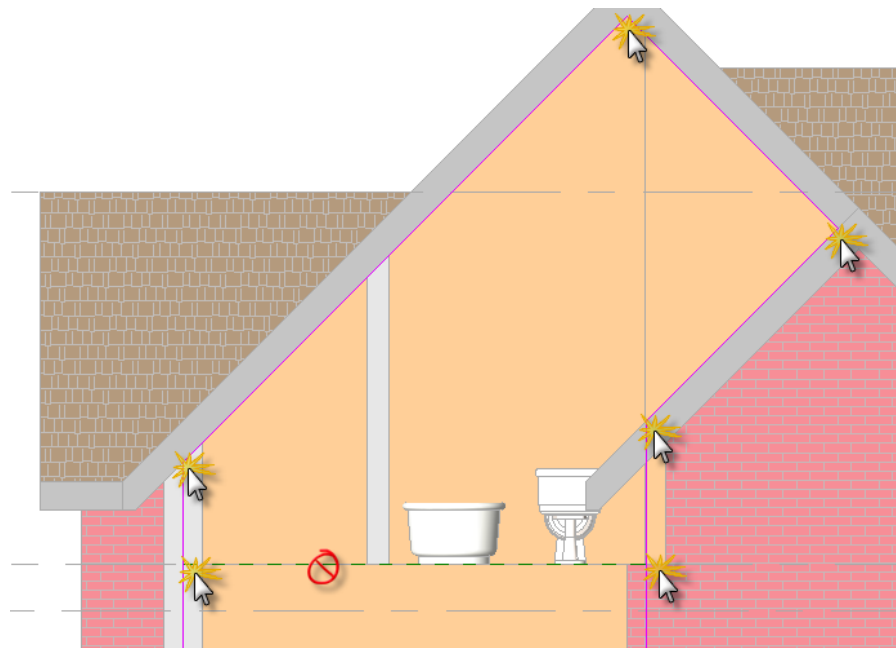


floor view as shown in this image. The dormer wall needs to wrap in front of the adjacent wall end.

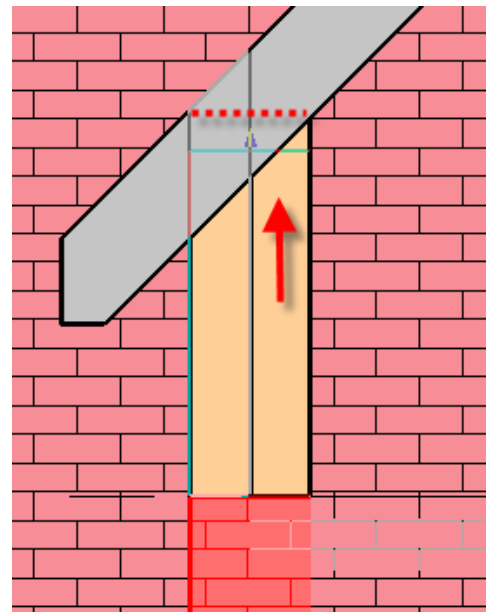
You may need to adjust the wall join AFTER you edit the profile as well as before.

11. Switch to a 3D view. Right-click over the View cube and choose Orient to View / Sections / Section 2. It looks like a 2D view but place your cursor over the upper left corner of the View Cube and pick it to switch to a southwest isometric, cutting through the dormer. Try clicking on all 8 corners of the box, to switch to the various vantage points.
12. Right-click on the 3D View in the Project Browser and choose Duplicate. Name the new view, Dormer Section. Right-click on the View Cube and choose Orient to View / Sections / Section 1. Use the view cube to change your view of the section.
13. The box-shaped frame around the view is called a Section Box. Select the edge of the section box to display its shape handles on each face of the box. Move your cursor over the down arrow on the top face of the Box and pick and drag it down into the model. Try adjusting some of the other faces, increasing and decreasing the extents of the visible area. The section box works like a crop region in a 2D view, allowing us to limit the scope of the displayed area.
14. In the properties palette, disable the Section Box option. Turn on the Crop region which is still available in 3D Views and try orbiting the view. Turn the crop region off.
15. Activate the default 3D view. Switch to a Southwest isometric view and zoom in on the garage.

16. Pick the short wall between the two main walls at the front of the garage and from the Options bar, choose Detach and then pick the roof. Pick the main front wall on the left that extends up to the high point on the roof and on the Ribbon, choose Edit Profile.

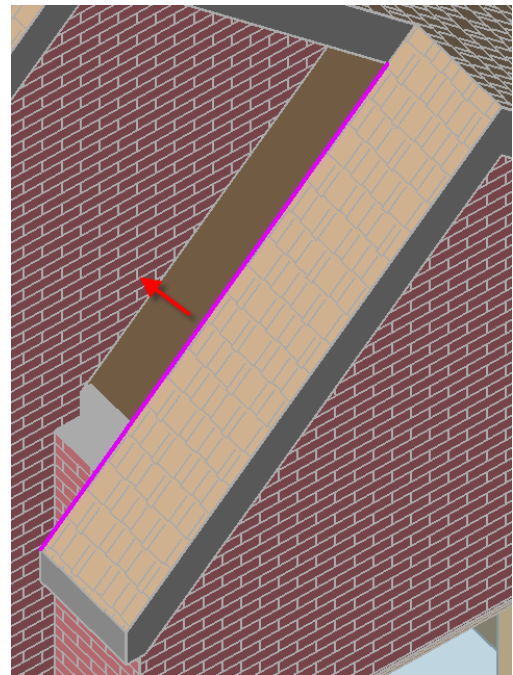


17. Switch to the South Elevation View and delete the top horizontal sketch line.
18. Drag the two side segments up to the eaves above and then add the remaining three lines by tracing the edges.
19. When you have closed the profile, Finish Sketch and accept any warning that may appear about objects not remaining joined.
20. While still in the same view, drag the short section of wall upwards, using the shape handle to bring the wall up to the eaves level. Use Join geometry to clean up the overlapping portion.



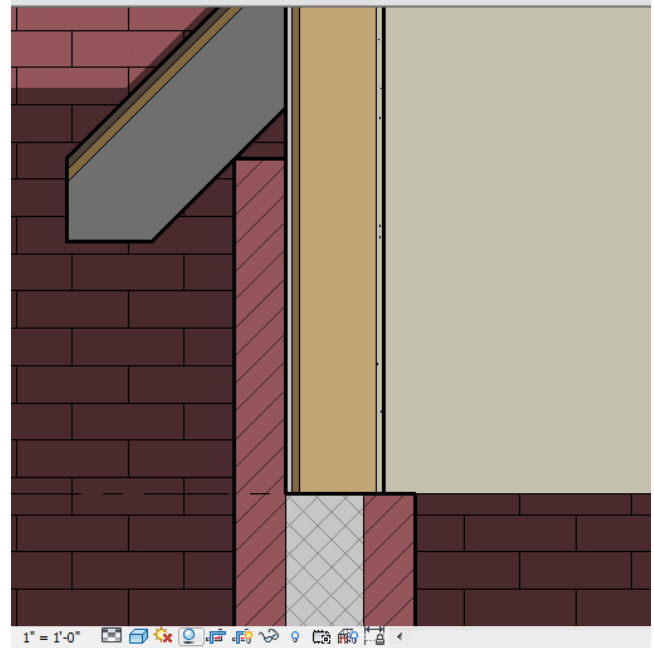
21. *****Experiment with the Wall Joins tool when presented with this type of condition. Adjusting how the front and side walls join at the corners will affect how gaps or profile edits will work in situations like this. Go to the first floor plan view, use Modify Wall Joins, and set the join type to miter to obtain a full gable outline on the front elevation.***

22. If you switch to a 3D View and pick the wall you just edited, you may see a warning marker appear on the options bar. This would be related to the position of the interior wall at the back of the guest bathroom overlapping a portion of the exterior wall that was just extended in the previous step. Depending on your wall attachments in this area, you may not have an overlapping condition. If this is the case, you can skip steps 22 and 23.
23. Yellow Warning icons appear when walls overlap. If you pick the warning icon on the options bar, a dialog box will appear with a text description and a show button which can be used to highlight the problem area.
24. One Solution to overlapping walls is to use the Cut geometry tool to remove the overlapping portion. The order you select the walls will affect the outcome. Try it both ways to see the affect.
25. Select the roof and hide it temporarily. Take a look at the walls from both sides and decide which wall you need to be cut by the second wall. The first selection will get smaller. If it doesn't work as expected, hit CTRL-Z and reverse the order. ☺
26. After cutting the overlapping walls, zoom in to the low roof that should extend into the wall we just edited. Select the Roof by Extrusion method and when prompted for a work plane choose the Pick a Plane method and select the back vertical face of the existing roof section. The top edge of the correct plane is also the one highlighted to the right.
27. Use the Pick tool to select the edge of the existing roof as shown here. Use the TAB key to cycle the available selections if the top face of the roof is highlighting. After picking the line, lock it to the existing edge.
28. In the Properties palette, set the Extrusion end value to 1' 0". Set the Rafter cut to Two Cut Plumb with a Fascia height of 6". Pick the green arrow on the Ribbon to Finish Sketch.
29. From the Modify tab on the Ribbon, pick the Join Geometry tool. Pick the extruded roof and then pick the main roof to combine the two.



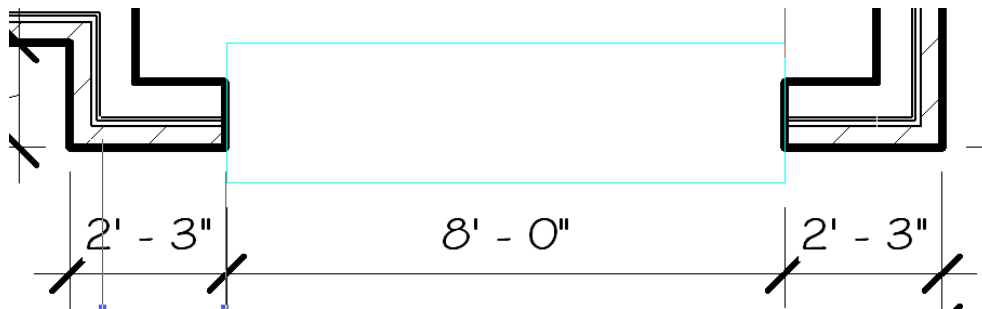
30. Pan the view over a bit to the Porte Cochere walls below the dormer. These walls have not yet been attached to the roof above.

31. Switch to the Dormer Section view. Because these walls do not have an interior finish, If we simply raise the top of this wall the brick finish will appear inside the room. To get the brick to move up in the front section under the roof, but still retain an interior finish in the dormer, unlock the brick component on one side of the wall and then move it up with a 2' 0" top extension to the wall. After adding the extension, switch to the Section 3 view, zoom in on the wall below the window and use the Align tool to pull the face of the dormer wall in line with the inner face of the brick.



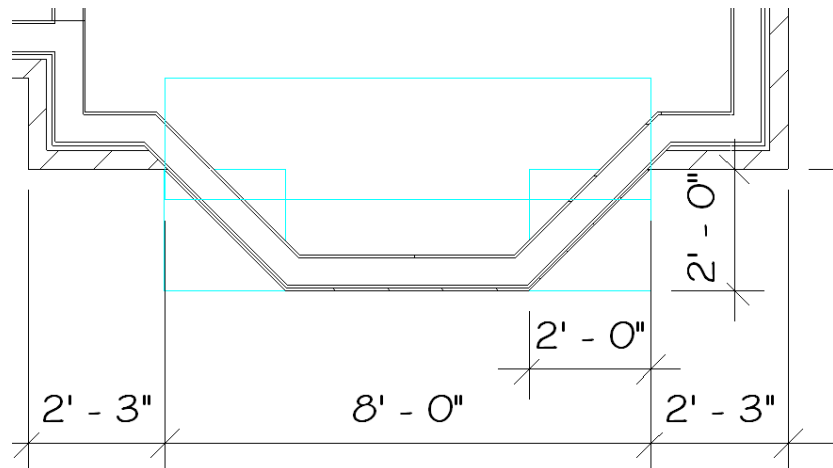
32. Switch to the First Floor view. Type CM to access the Component tool and from the Type Selector, choose Opening – Elliptical Arch: 36"x84". Add the opening in the wall leading into the Powder room on the first floor. Add a second opening in the wall from the Entrance hall to the Great Room. Pick this opening, and in the Element properties palette, pick Edit Type and then Duplicate. Create four new sizes for 72"x84", 96"x84", 120"x84" and 120"x120".
33. Add the 72" opening to the Great Room, the 96" opening to the Living Room, and the 120"x84" opening to the Dining Room. Use the 120"x120" opening to create the passageway arches through the Porte Cochere. For the latter, set the base elevation offset to -1'-10" to place the bottom of the opening at grade level.
34. Switch to a 3D view so you can see the large arches. Switch to an elevation view. Select one of the large openings, edit the type parameters, and change the Spring height to 3'-0" to make the arch on these openings more pronounced.

35. Go back to the First Floor view and zoom in around the living room. We are going to cut an opening in this wall to lead out to a Bay window. It will be a different type of opening in this location. We want an 8 foot wide opening in the middle of this wall, extending from the floor to the ceiling. Placing a wall opening at floor level will also cut away the section of wall extending down to the foundation level so we can add a new angled set of walls to define the Bay. This type of feature is easier to place if you draw a couple of detail lines or reference planes first and dimension them to set the locations for each end of the opening. Since we will be covering reference planes and work planes a bit later in the course, use detail lines from the Annotate tab on the ribbon to add lines which will only be visible in one view. Use the Line Style settings to create a line style called Blue Lines.



36. Set the color to a light blue. Later, when we are ready to plot the drawing we can modify this line style and change the color to white making the lines not plottable. Sketch and dimension a rectangle guideline as shown above.
37. From the Architecture tab, choose Opening / Wall Opening and carefully pick the start and endpoint of the line to coincide with the rectangle guidelines. Pick Modify and then select the opening and look in the properties palette. Set the Top Offset to 0 and the Top Constraint to Top of Plate 1. Pick Ok.

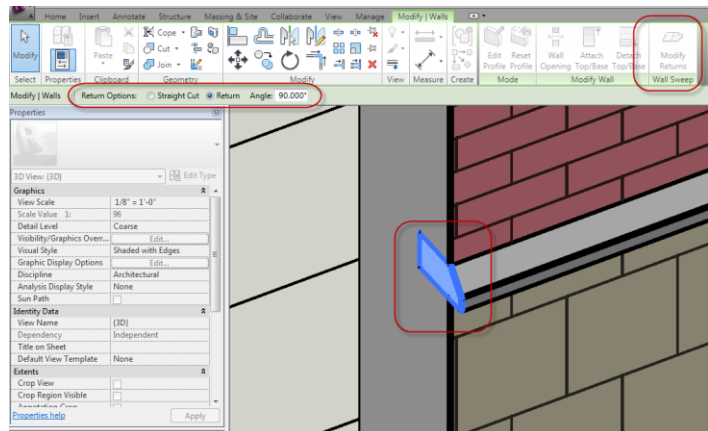
38. Draw two more rectangles as shown at right, to act as guidelines for sketching in the bay walls.



39. Duplicate the interior partition wall and create a new type called Exterior: 7" Wood Frame. Replace the gypsum board on one side with a wood finish material. Use wood siding as a starting point but disable the surface pattern display for the horizontal siding. Add a ½" Substrate layer of wood plywood to support the exterior finish. Add the three walls, using a Base offset of -1' 2" and a top constraint of Top of Plate 1
40. Add a Footprint roof with a 6" overhang, using the Wood Rafter roof type. In the roof properties, set the Base level to Top of Plate 1, the base offset to 0'-0", rafter cut to two cut plumb with a fascia depth of 6", and the slope to 12"/12". Make sure you disable the slope for the back face of the roof where it will attach to the wall. Add windows to each of the 3 bay walls. Switch to a South view and then a 3D view to admire your handiwork.
41. We will now add some sweep features. From the Insert tab on the Ribbon choose, Load from Library, Load Family. Browse to the Profiles / Wall folder. Find the Sill-Precast profile and pick Open to load it into the current project.
42. On the Architecture tab of the ribbon, from the Wall dropdown, choose Wall Sweep and in the properties palette pick Edit Type. Duplicate, create a new type called Sill and change the profile to Sill-Precast: 5" wide.
43. Pick ok and then float your cursor over one of the Porte cochere walls and pick to place the first sweep. Pick Modify and the sweep will appear. In the properties palette, set the height to 3'-2".

44. Select the wall sweep and on the options bar pick Modify Returns. Float your cursor over the open end of the sill at the arch opening to add the return as shown at right. (not complete yet.)

45. Pick the sweep and View the available properties to view the constraints, level and offsets. Change the offset from level to 2' to move the sweep down. Set it back to 3'-2" to align the sweep at the top of the stone portion of the wall.



46. After adding sweeps to both sides of the porte cochere walls, and setting a 90 degree return for each, use the Align tool to move one sweep return face across to connect to the opposite sweep return face.

47. Pick one of the main, house walls and open the type properties. Pick edit structure to access the Edit Assembly dialog. Set the preview to section and pick the Sweeps button. Pick Add and under Profile, change Default to Sill Precast 5" wide. Under distance enter 2' to set the insertion height 2 feet from the Base. Pick Ok and you should see the sill appear in the preview window. Pick Ok three times to exit and apply the sweep.

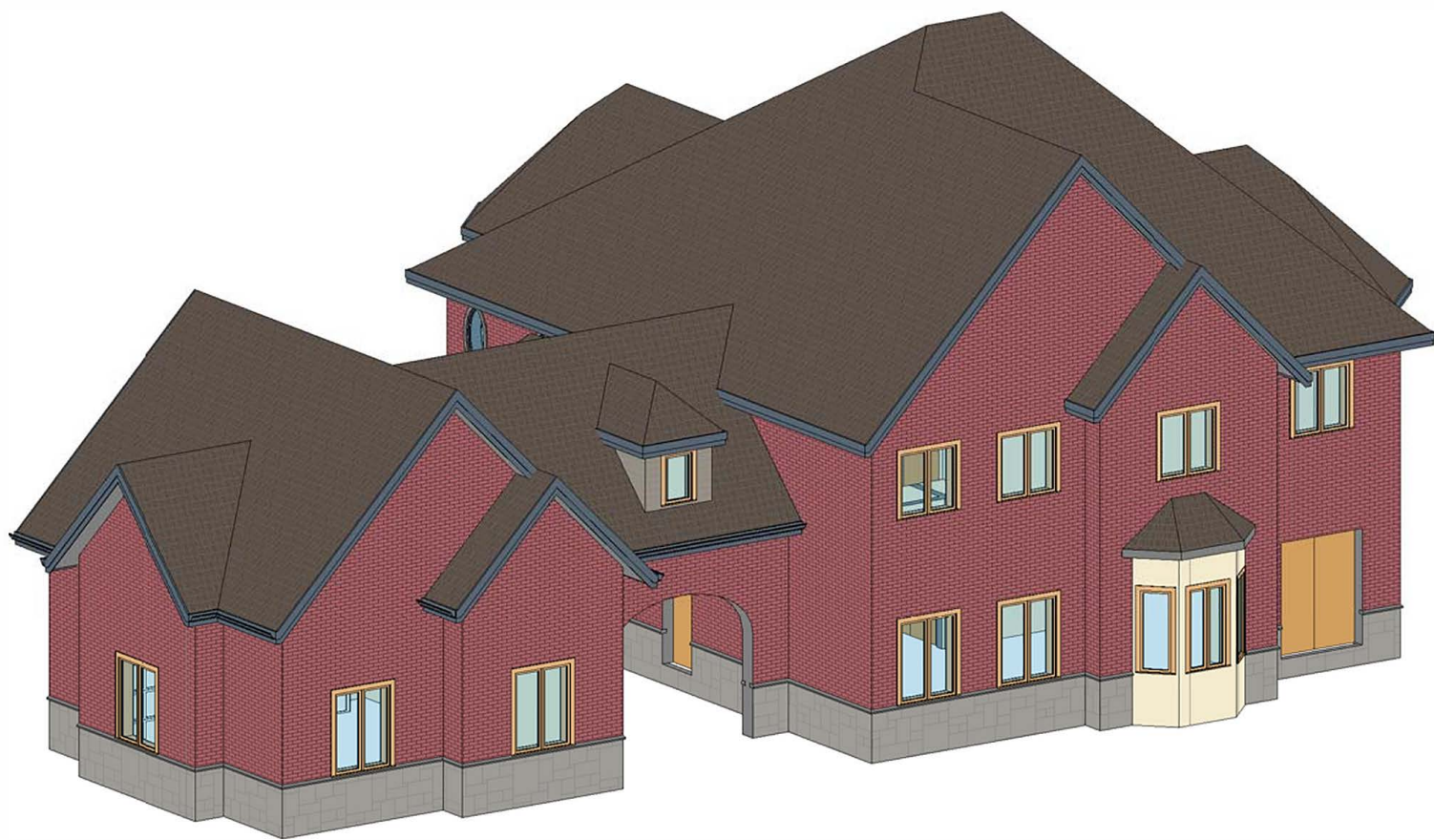
48. Select a garage wall, duplicate the type and make a new one called exterior Brick on wood stud-Garage. Modify the garage wall type to adjust the height of the stone section and the height of the sill sweep by 1'-2".

49. Switch to the Roof Plan view and add a Dormer opening where the low roof of the garage joins with the main roof. It is not really a dormer but this operation will still work to cut an opening between the two roofs and allow you to add fascia and gutters to either side of the low roof.

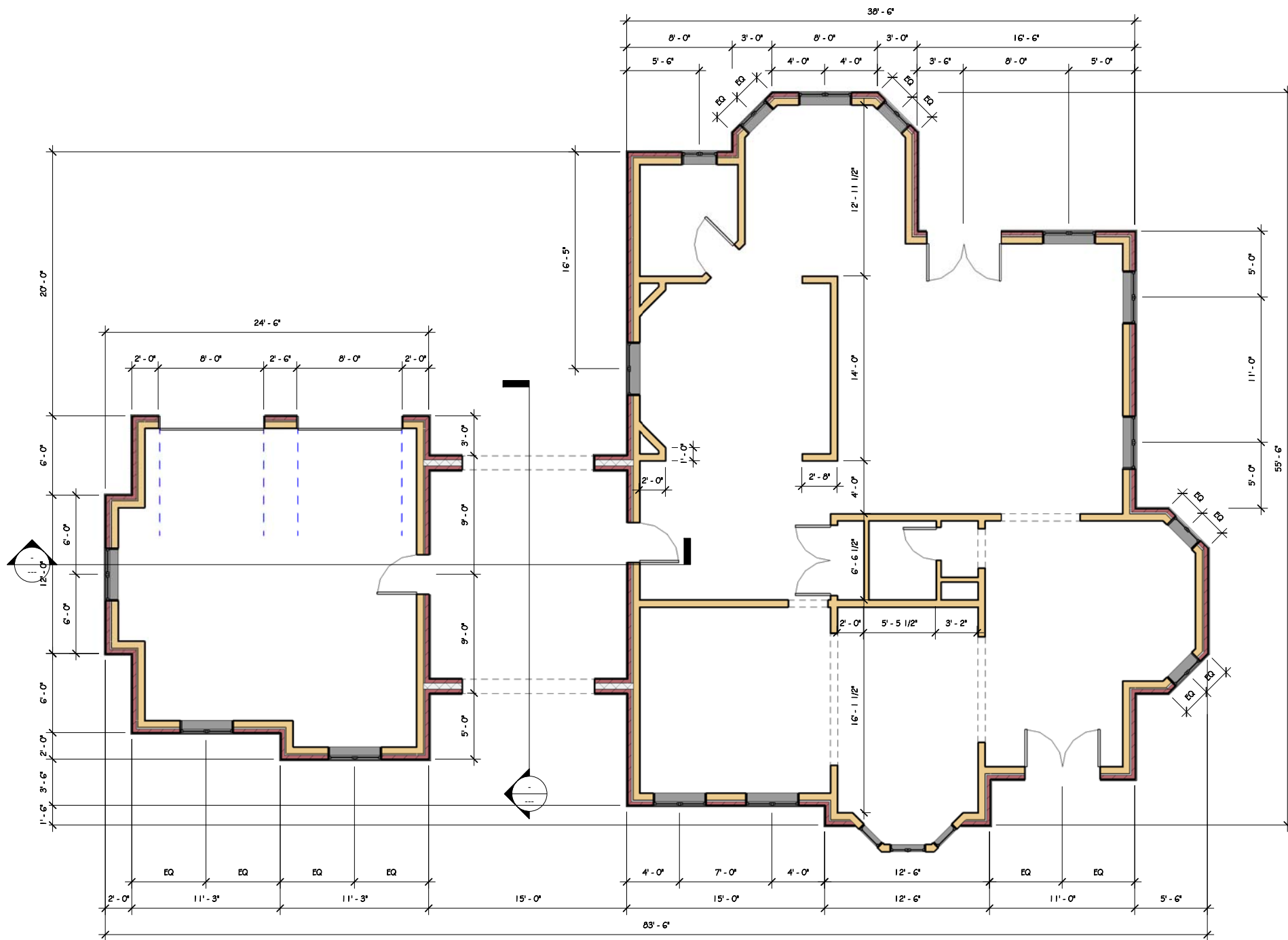
50. Load two new profiles from the Profiles / Roofs folder called Fascia-Built-Up and Gutter Profile – Cove. Use the CTRL key to load both profiles at one time.

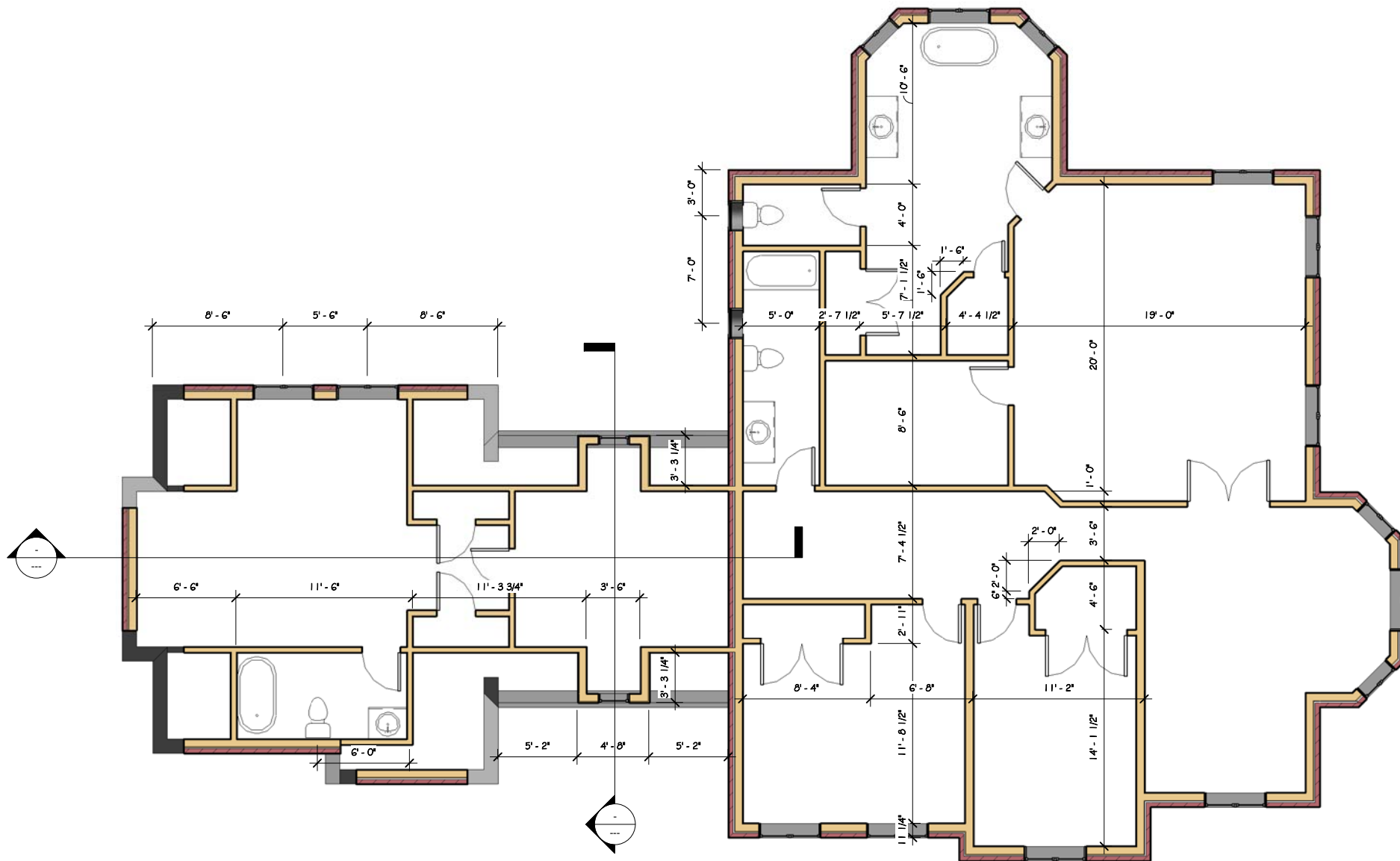
51. From the Build panel's Roof dropdown, choose Roof: Fascia. In the properties palette pick Edit Type and create a new type called Fascia-Built up 1x10 w 1x6. Pick OK and zoom in on one of the existing roof edges and pick the top edge of the eaves to add the first section of Fascia.

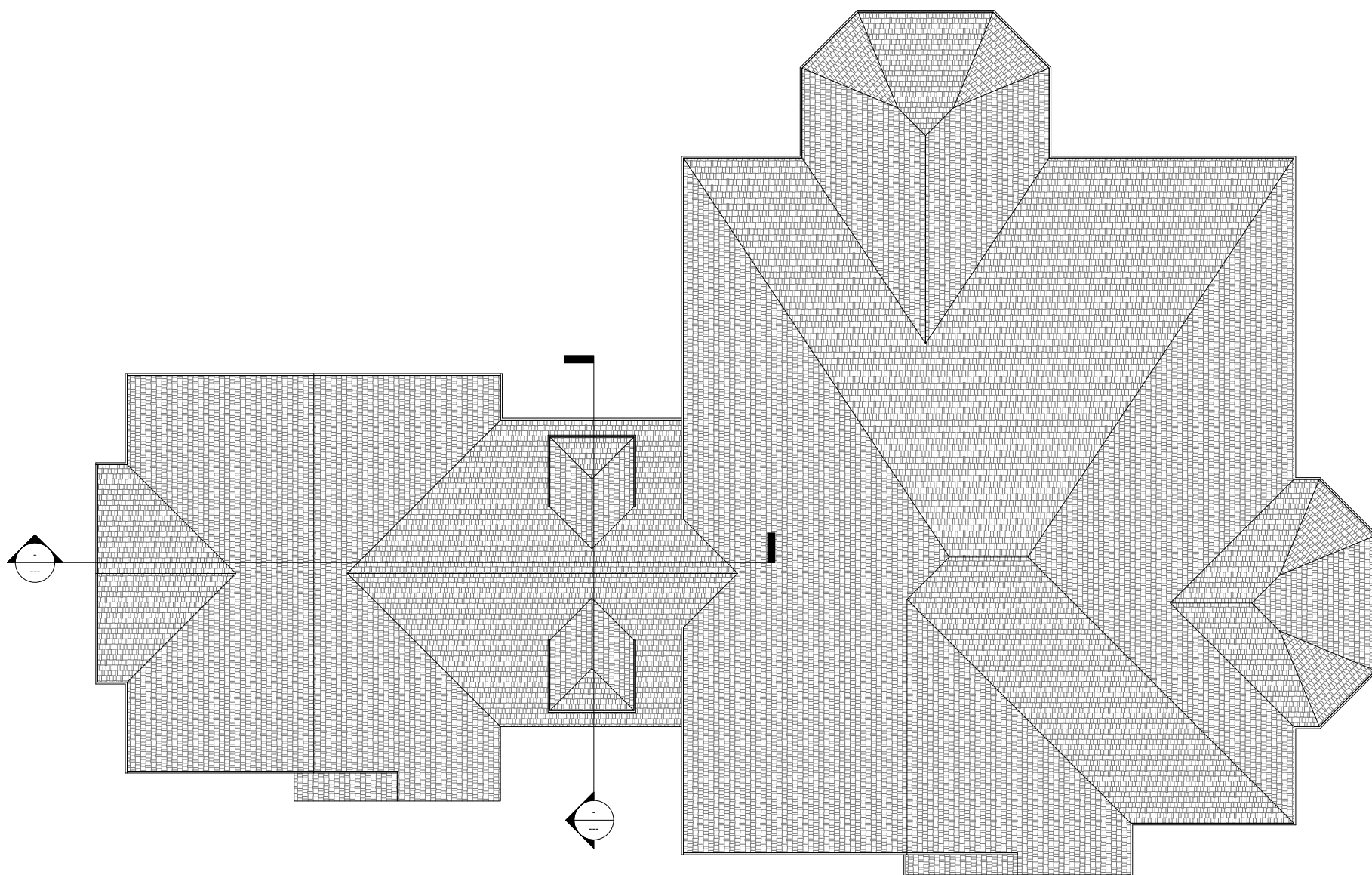
52. Continue to orbit the view of your model picking additional segments. If you need to stop picking segments while changing your view, make sure you pick the existing fascia and choose Add / Remove segments on the Options bar to continue adding the remaining sections. You should have one continuous fascia sweep for each roof.
53. After adding the fascia boards you can add gutter sweeps to any horizontal sections of fascia to aid in directing rainwater from the roof to a downspout location we can add later. From the Build Panel's Roof dropdown, choose Gutter and open element properties. Duplicate the Bevel 5" x 5" type and create a new type called Cove 4"x4" which references the appropriate profile. Pick Ok, close the dialog and start picking the top edges of the Fascia which we added in the previous step. Do not add the gutter to the dormers but do add it to all other horizontal fascia boards.
54. Well. This has been a marathon of a lesson with lots of new features to practice. Continue to apply the techniques outlined in these notes to the remaining sections of the building. Edit the wall profiles where required to close all walls to roofs including the dormer walls. Use the Join geometry or Cut geometry tools to clean up all overlapping elements. Add the sill profile to the remaining main floor, exterior wall types. Continue to add any interior walls, openings, and doors as well as windows to the guest suite. Check building elevation views frequently while adding windows on the second floor and use alignment constraints to align the windows between the two floors.
55. Save and close your project. Always be sure to make backups of your work. At this point you have a considerable amount of effort tied up in this project and it would be tragic to lose it. We will continue in the next class by adding floors to the project and tying up any other loose ends in the building envelope.









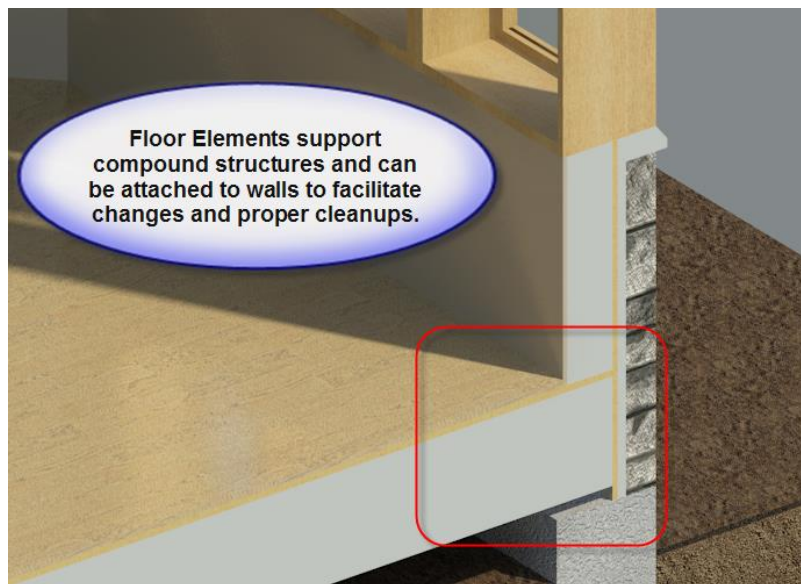


AGENDA:

1. Floors
2. Floor Slab Edges
3. Foundations

1. Floors

Revit allows you to define floors by sketching their perimeters. You can use the line tools to draw the perimeter with lines and arcs, or you can use the Pick Walls tool to create the boundary from existing walls.

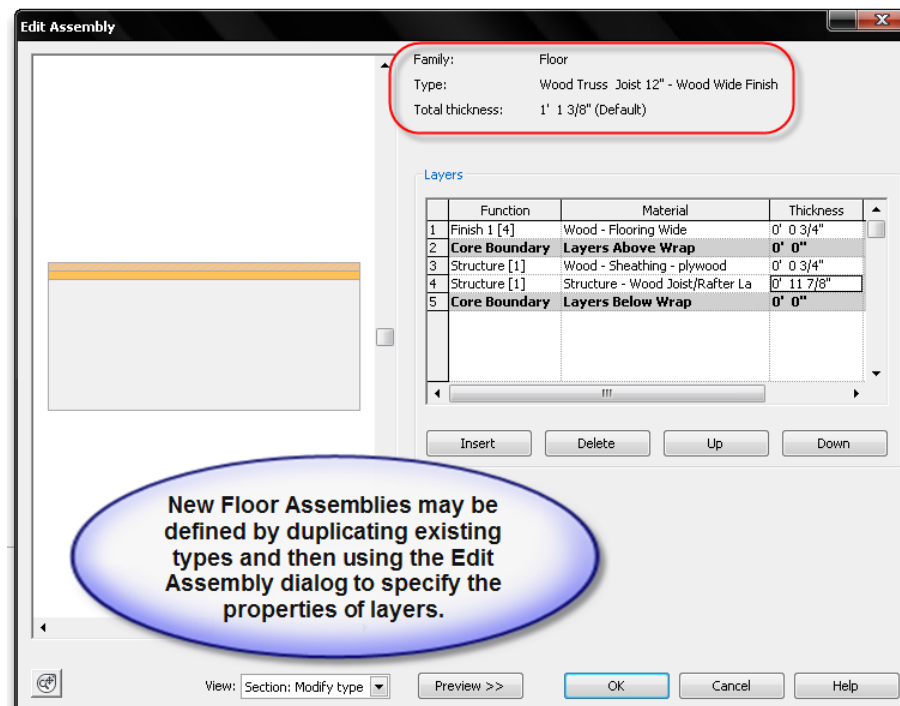


When you define the boundary for a floor, if you choose to extend the floor to the Core face, you will be able to select the core boundary on the exterior side and have your floor cut through the wall and attach at the outer face of the structural wall. When a floor is attached to a wall, it will update and resize to follow the wall if the wall is moved.

Floors are typically sketched in plan views but it is also possible to start a floor in a 3D view or elevation. When you start a floor sketch in an elevation view, you will be prompted to select an existing plan view in which the sketch will be created.

Different types of floor construction are available as Types in the Floor Family. There are generic floor types with a single component slab as well as more complex types which include different layers to define the structural and finish components.

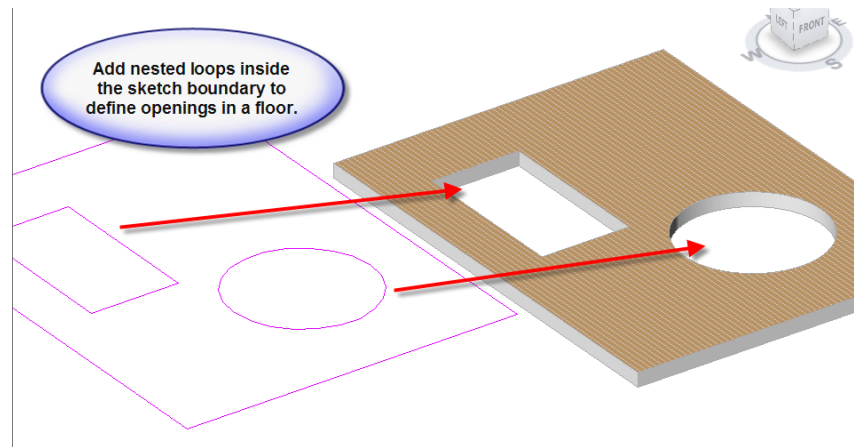
Custom floor types may be created with any number of layers in the same manner that compound walls are defined. Editing a Floor Assembly displays fewer options than walls with no tools for splitting, merging, or applying sweeps and reveals.



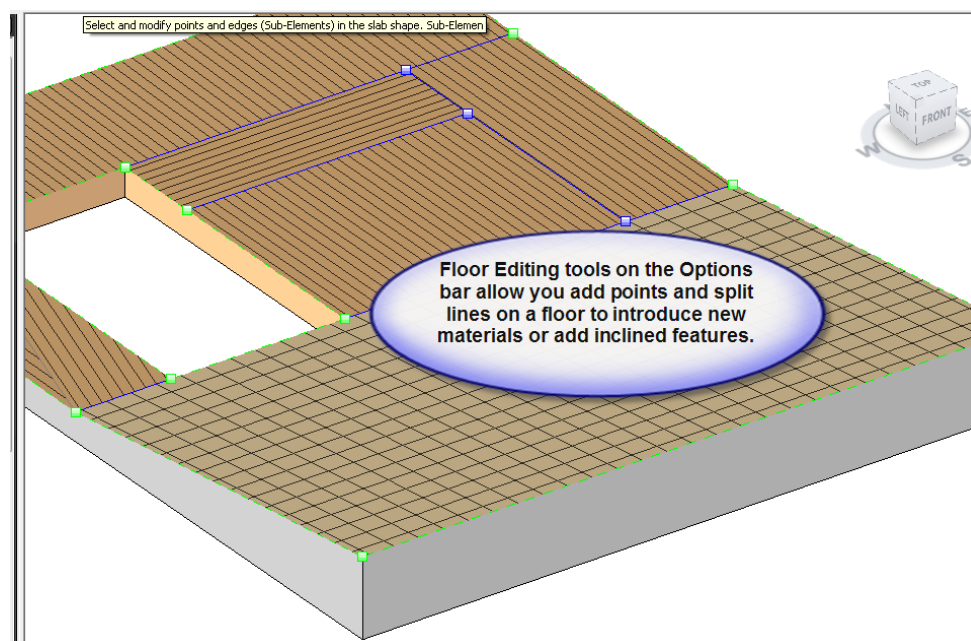
Sloped Floors may be created by adding a slope arrow to the floor sketch. Slope arrows let you specify a height at the tail of the arrow and another height at the head of the arrow. The floor will maintain constant thickness but will be rotated so the floor surface passes through the elevations defined by the slope arrow properties.

A second method for creating a sloped floor is to select one of the perimeter lines in the floor sketch and access its element properties. Select the Defines Constant Height parameter and you can then specify an explicit offset height from the base elevation for that edge, or you set it to Define Slope which will open up the Slope Parameter.

When you sketch floor boundaries, any nested loops inside the overall perimeter will define a hole or opening through the floor assembly.



Floors may be edited directly, outside of the sketch environment, by using the Shape Editing tools on the Ribbon which appear when a floor is selected.



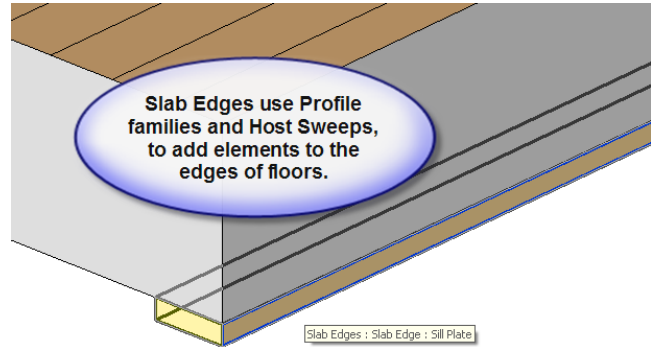
Floor Edit tools allow you to add Modify the elevations of selected points or edges on the floor. You can also add new points and draw split lines along the floor surface. Split lines define new faces or regions within the floor on which you can paint new materials.

2. Floor Slab Edges

Slab edges may be added to horizontal edges of selected floors through the use of Hosted Sweeps. The shape of the slab edge is defined with a profile family, similar to the way we define wall sweeps or roof sweeps.

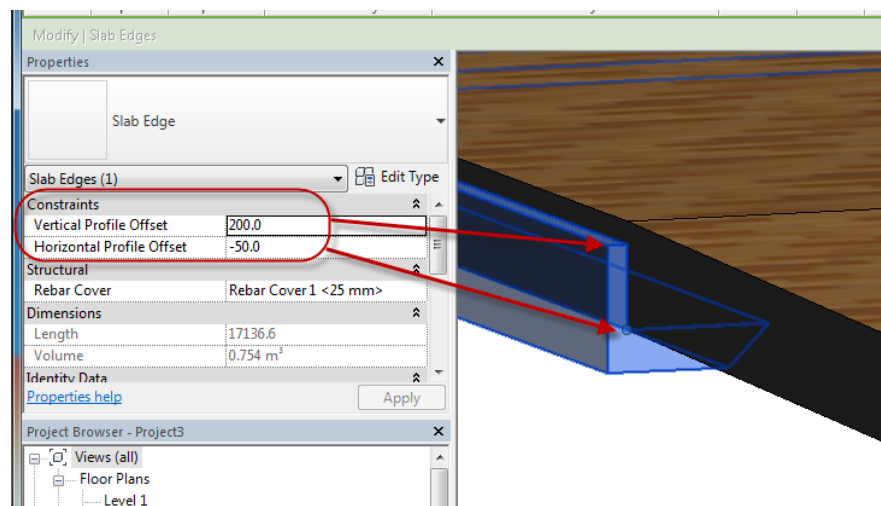
Slab edges cannot be added in the Edit Assembly dialog as we can with Wall sweeps but must be added after the floor has been created.

The default Slab Edge profile is used to represent the thickened edge of a concrete slab floor, but by defining your own profile in the Family Editor, it is possible to create swept elements with any closed shape.



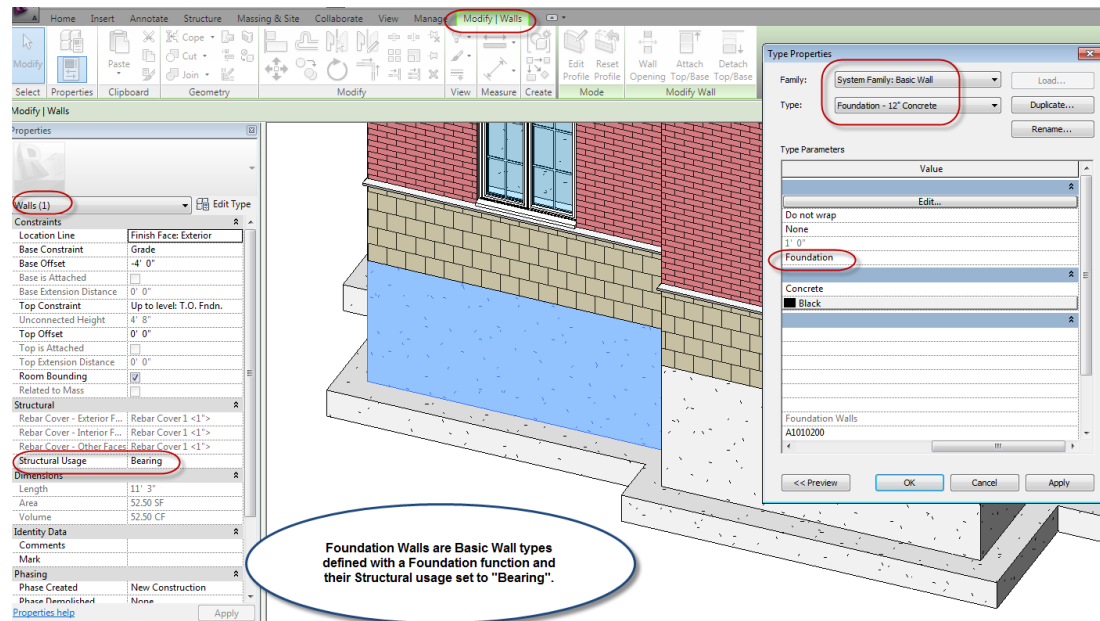
When you define a Hosted Profile, you set the insertion point of the profile relative to the position of the Host, so you should be able to preset the position of the sweep so it is added in the appropriate position when you select the Host sweep edges on the floor. If the profile insertion point is on the wrong side of the profile, the sweep may be added inside the floor or even upside down. Selecting a slab edge will display flip arrows that allow you to mirror the sweep around the horizontal or vertical axes. These options are also available from the cursor menu.

If you need to edit the position of the slab edge relative to the host edge, vertical and horizontal offsets parameters in the element properties dialog are available.



3. Foundation Walls

Revit allows you to draw Foundation walls and footings with the Structural Wall tool on the Structure tab of the Ribbon or with the regular wall tool.



Foundation walls are walls that are defined with a basic wall type with the wall Function construction parameter set to Foundation. The Structural usage for foundation walls will be set to bearing.

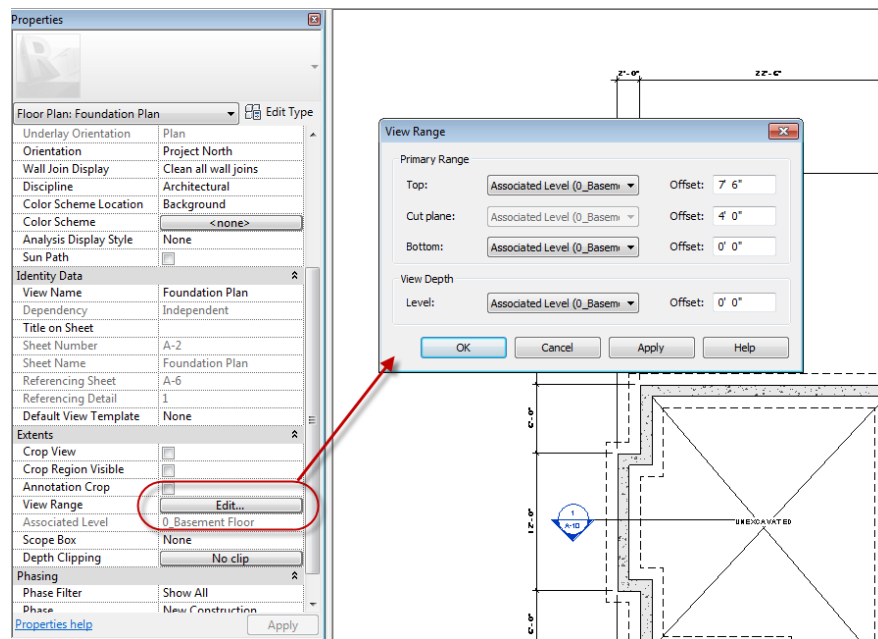
When you add a foundation wall type, the vertical extents of the wall are defined with a depth parameter on the options bar instead of the typical height. When you examine a foundation wall's element properties however, the familiar Base constraint, Top Constraint, offsets and extensions are all available. Setting the top constraint to Unconnected also displays the Unconnected Height label instead of the term "depth".

Foundation walls may be drawn by picking points as you would draw normal walls, or if you have already drawn the exterior walls of the building, you can use the Pick Lines tool to trace the walls above.

Foundation walls can be drawn in a basement plan view with the base constraint set to top of footing and the top constraint set to top of foundation, if these levels have been defined. You need to work in a level above the base constraint level for this method to work correctly.

When you draw Foundation walls, in a project started with the Residential template, you can draw the walls in the Foundation view and you will be able to see the walls as you draw them. If you use the Default template or a custom template in which you define your own level for a Foundation, you may need to adjust the View range for that level so you can see the walls as you create them.

The View Range setting is a set of parameters available for Plan view types which defines the vertical extents of the view. The View range is a set of four horizontal planes that control the display of objects in a view.



The Primary range lets you set the top and bottom clip plane for a view by selecting a level and specifying an offset from that level as well as the height of the cutting plane. The view depth is an additional setting that allows you to set a depth for the display of elements below the primary range. By default the view depth is coincident with the bottom plane.

To specify a working view range for drawing a foundation wall from the Top of the Foundation level, set a negative distance for the offsets and view depths equal to or greater than the depth of the foundation.

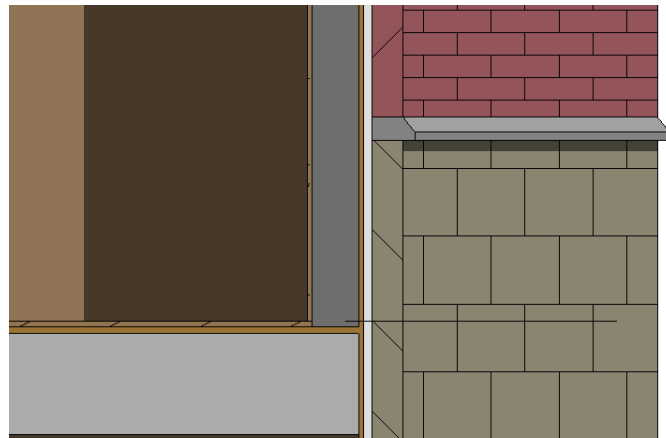
Adjusting the View Range is critical to properly displaying a Plan View showing multiple levels, such as first floor and second floor, in a single view.

Exercise Notes

In the following exercise we will define custom floor assemblies and add floors to the Manor House project. With the floors in place we will then add the foundation walls and footings to define the preliminary structural support system for the building

1. Open the Manor House project and set the First Floor View active. At this point all interior and exterior walls should be in place and all roofs should have been added. Sweeps should be in place for stone sills on the exterior walls, built up fascias should be applied to all roof eaves, and gutters should be applied where appropriate. Wall profiles have been edited where required and overlapping elements have been joined to clean up connections.
2. Set the detail level to Coarse. From the Build panel on the Ribbon, choose Floor. On the Options bar, set the Offset to 0'-0" and choose the Extend into Wall (core) option.
3. Choose Edit Type from the Properties palette and in the Type Selector, choose Wood Truss Joist 12" – Carpet Finish and pick Duplicate. Name the new type Wood Truss Joist 12" – Wood Wide Finish. Choose Edit in the Structure parameters to open the Edit assembly dialog. Modify the Layer 1 Finish material and set it to Wood-Flooring Wide with a thickness of $\frac{3}{4}$ ". Pick ok twice to close the dialog.
4. Zoom on one of the exterior wall corners of the main house. Choose Pick Walls and move your cursor into the middle of one of the walls until it highlights and a dashed line appears indicating the border of the floor drawing along the outer core boundary. Press the TAB key and then pick to do a chain selection of the walls. Zoom back out and continue with the sketch by picking any remaining exterior walls. Trim or delete any extra edges until you have a closed boundary all the way around the main building footprint. Pick Finish Sketch. When prompted to Join the floor to the exterior walls, choose. Yes.
5. Zoom to Fit. Type SD to Shade the view. Turn on the Shadow display. Nice. 😊
6. Select the Section 1 section line and resize its extents, dragging it all the way through the building and out through the bay on the right side. Add a third section line cutting through the front door and out through a window in the back wall.

7. Double click the section head for the longitudinal section, to switch to section 1 view. Zoom in on a corner of the new floor at a wall connection. Set the detail level to medium or high. Type SD. Turn on shadow display. Try toggling the Thin lines off and on to see how it affects the visible edges. Check the distance from the underside of the floor to the top of the foundation and then adjust the T.O Fndn level height to -1'-3".

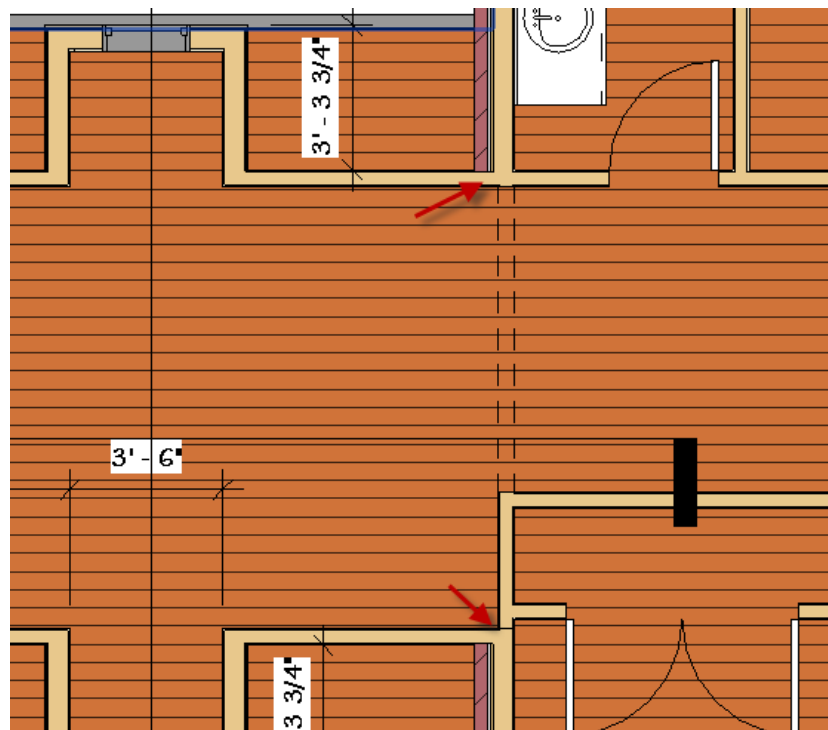


8. Select all main exterior house walls and increase base extension to -1'-3". Adjust exterior walls at porte cochere and garage as required to align sill sweeps so they align below the window sills.

9. Switch to the Second Floor view. Turn off any underlays you have visible. Pick the roof if it is visible around the edge of the guest suite, right-click and choose Hide In View / Category.

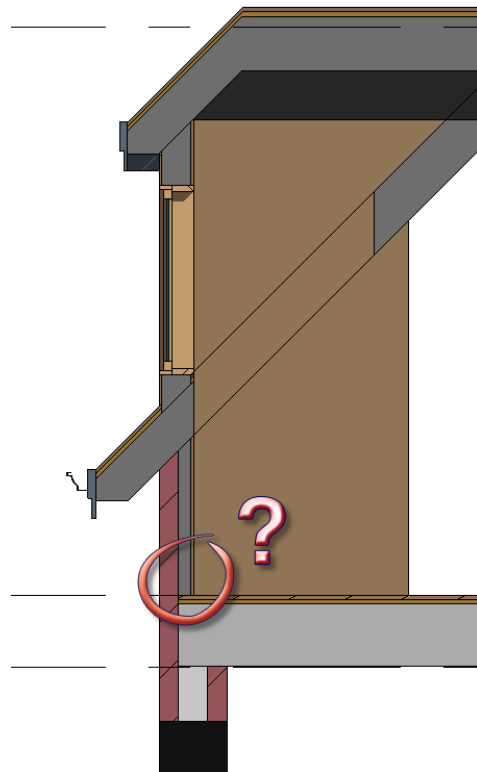
10. Zoom in to the main wall that still divides the guest suite and den from the rest of the house. Split the wall in two steps to divide it into 3 segments.

11. Select the middle segment and change its top constraint to Top of Plate 1.



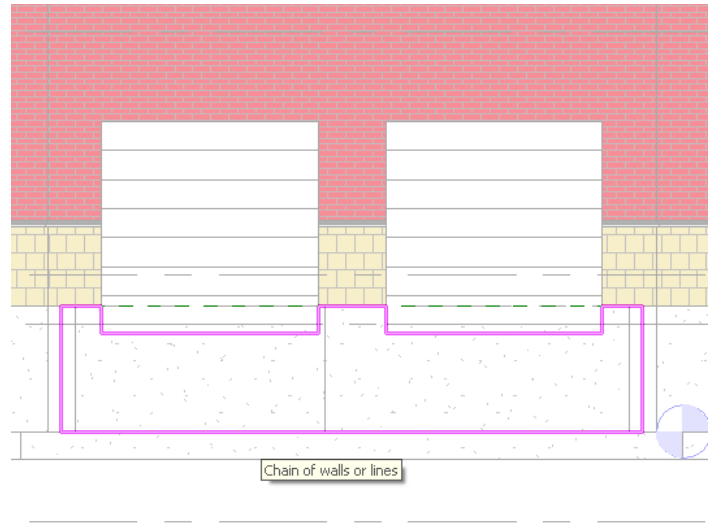
12. Set the detail level to coarse. Add a new partition wall where the previous wall has now been lowered to the first floor ceiling and is no longer visible. Add an 84" elliptical arch opening in the new wall to provide access from the main building. (create new 84" wide type)

13. Create a new Floor over the entire second floor of the building. You could do this floor in separate sections and if the floor structure varied this would be advisable. We will use the same floor type throughout, so we'll make a single perimeter loop in one step. Use the same method as for the first floor, extending the floor boundary to the wall core.
14. When you finish the sketch, you'll receive an option to "have the walls that go up to this floor's level attach to its bottom and the exterior walls around the garage are being highlighted. We are already attaching these walls to the Roof or have edited their profiles at the top, so PICK NO!! Next, you'll see the option to join the floors to the exterior walls and you do want to pick Yes for this option.
15. Shade the display of the second floor. Enable shadows and note their relative lengths on the inside and outside of the building where they are hitting at different elevations. In the Properties palette, choose the Edit button by View Range. Move the dialog so you can still see the floor plan. Change the Cut Plane elevation from 4'-0" to 1'-0". Pick Apply. Check it at 6' and then put it back to the default 4'-0". Close the View properties dialog.
16. If you have not yet renamed your section views, do so now. Section 1 will become the Longitudinal Section. Section 2 will become Dormer Section, and Section 3 will be called Cross Section. Double click the Section head for the Dormer Section and zoom in to see how the floor wall connection at the dormer is shaping up.
17. If you traced the walls for the second floor along the perimeter of the walls below some adjustments may be in order. The front wall of the dormer needs to be aligned with the face of the core component in the porte cochere walls below. Use the Align tool to shift the dormer wall so the outer face of the plywood sheathing is in line with the outer face of the floor system.



19. If you examine the section closely and if you notice that the finish floor is extending under the exterior wall, this is not correct. Pick the Join Geometry tool, pick the floor, and then dormer wall to clean the connection.
20. Switch to the Basement Floor view. Set the Underlay to display the First Floor view above.
21. From the Structure Tab on the Ribbon pick Wall and in the type Selector choose Foundation- 12" Concrete. In the element properties set the Base constraint to T.O. Ftg. and the top constraint to T.O. Fndn. On the Options Bar set the location line to Finish Face Exterior. Trace the perimeter of the main building's exterior walls cutting straight at the living room bay window. (This section of floor and walls will be cantilevered and does not require a foundation).
22. When the foundation perimeter is completed, switch to a3D view. From the Structural tab, choose Foundation / Wall and in the type selector, choose Wall Foundation: Bearing Footing – 36" x 12". Move your mouse over one of the foundation walls and press TAB to chain select all of the walls. Pick to add footings to the foundation in a single step. ☺
23. Switch to the North view and zoom in around the garage. Create a new level called T.O. Ftg. 2 and set it to 4'-0" below the grade line.
24. Switch back to the Basement Floor. view and add foundation walls and footings below the garage and porte cochere. The wall's base constraint will be at the new level you just created.
25. Switch to a 3D view and add footings to the new foundation walls using the same method as for the main house walls in step 21. The location and position of the footings are derived automatically from the foundation walls and the footings always go in at the correct height.

26. Use the Edit Profile method to add a notch in the top of the foundation walls at both arch openings through the Porte Cochere as well as at the garage doors in the back wall of the garage. Set the depth of the notch to 11" below the top of the wall.

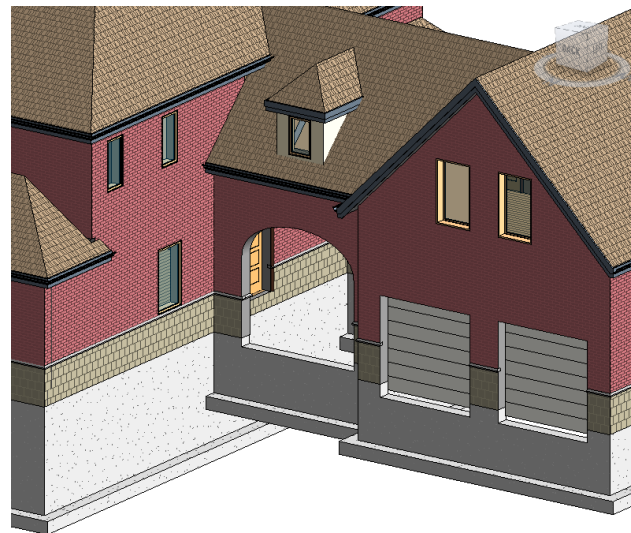


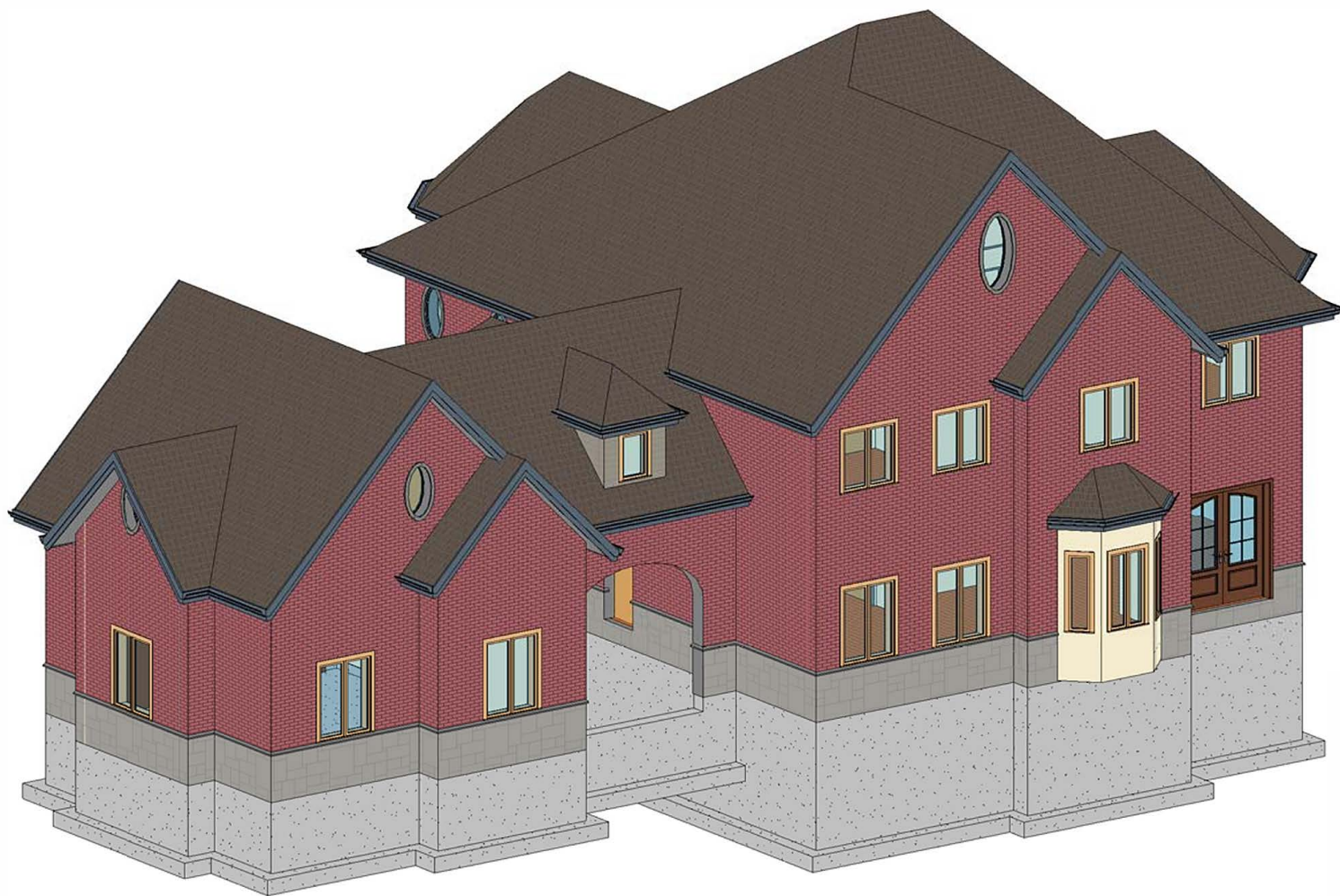
27. Switch to Basement Floor level and zoom in on the garage. We could add this slab in the Grade level as well, but the basement floor level will make it easier to align the floor slab with the Foundation walls. Start the floor tool and create a new floor type by duplicating an existing floor type. Create a single layer with Concrete in place material and a thickness of 4". Under Constraints set the level to Grade. Use the Pick Walls option and clear the "extend into wall" option before doing a Tab select to pick the chain of garage walls. Finish the sketch. Switch to the Basement view and add a second floor slab inside the main building and with the constraint set to Basement floor level.

28. Select one of the footings and type SA to select all instances. Apply an element override to all of the footings to show their Projection edges with a Hidden linetype and to turn off their surface pattern.

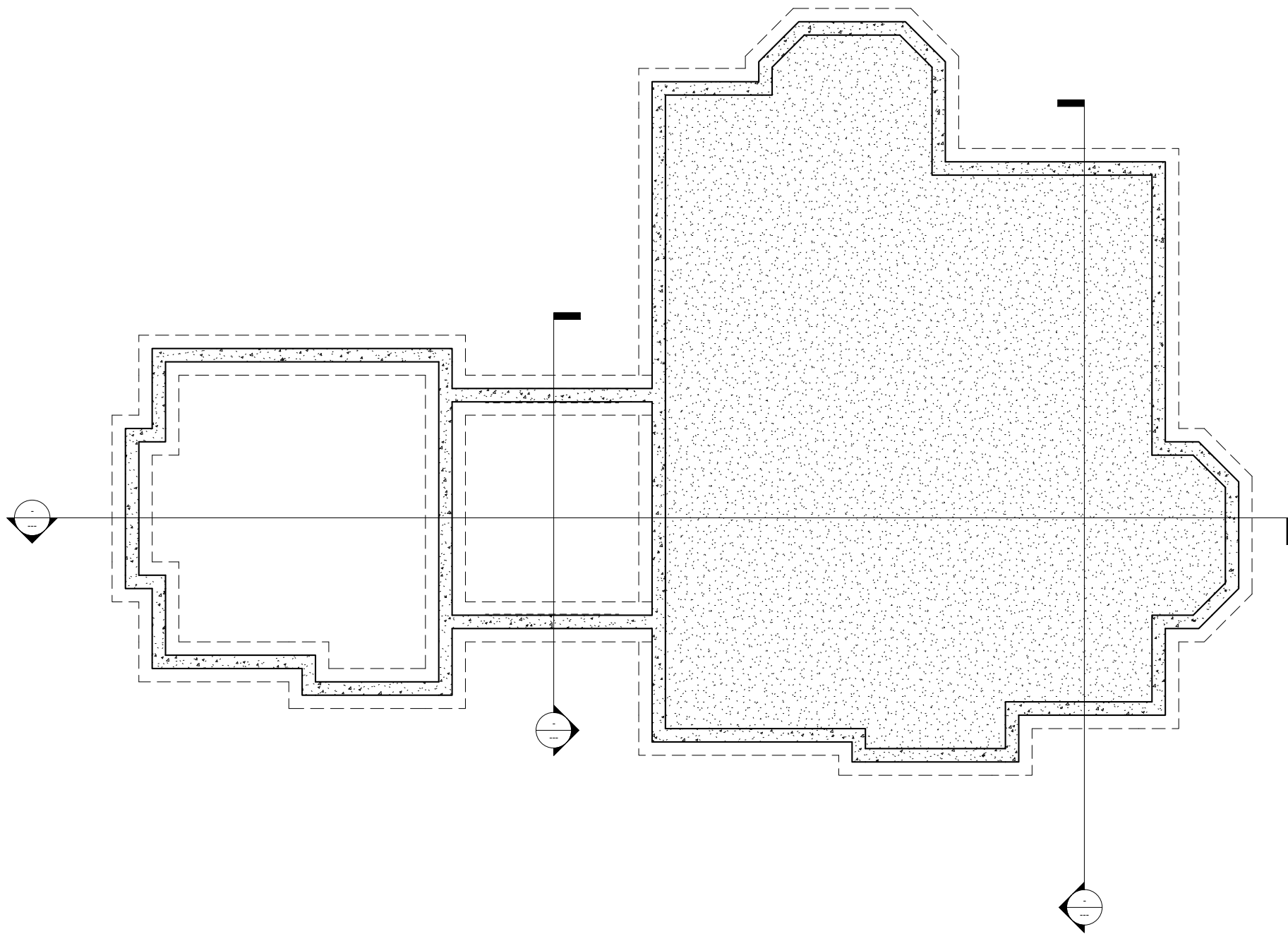
29. Switch to each of the main section views and examine the connections between the interior partitions on the first floor and the floor above. Use the Join geometry tool to clean up the connection between the walls and floors where they meet.

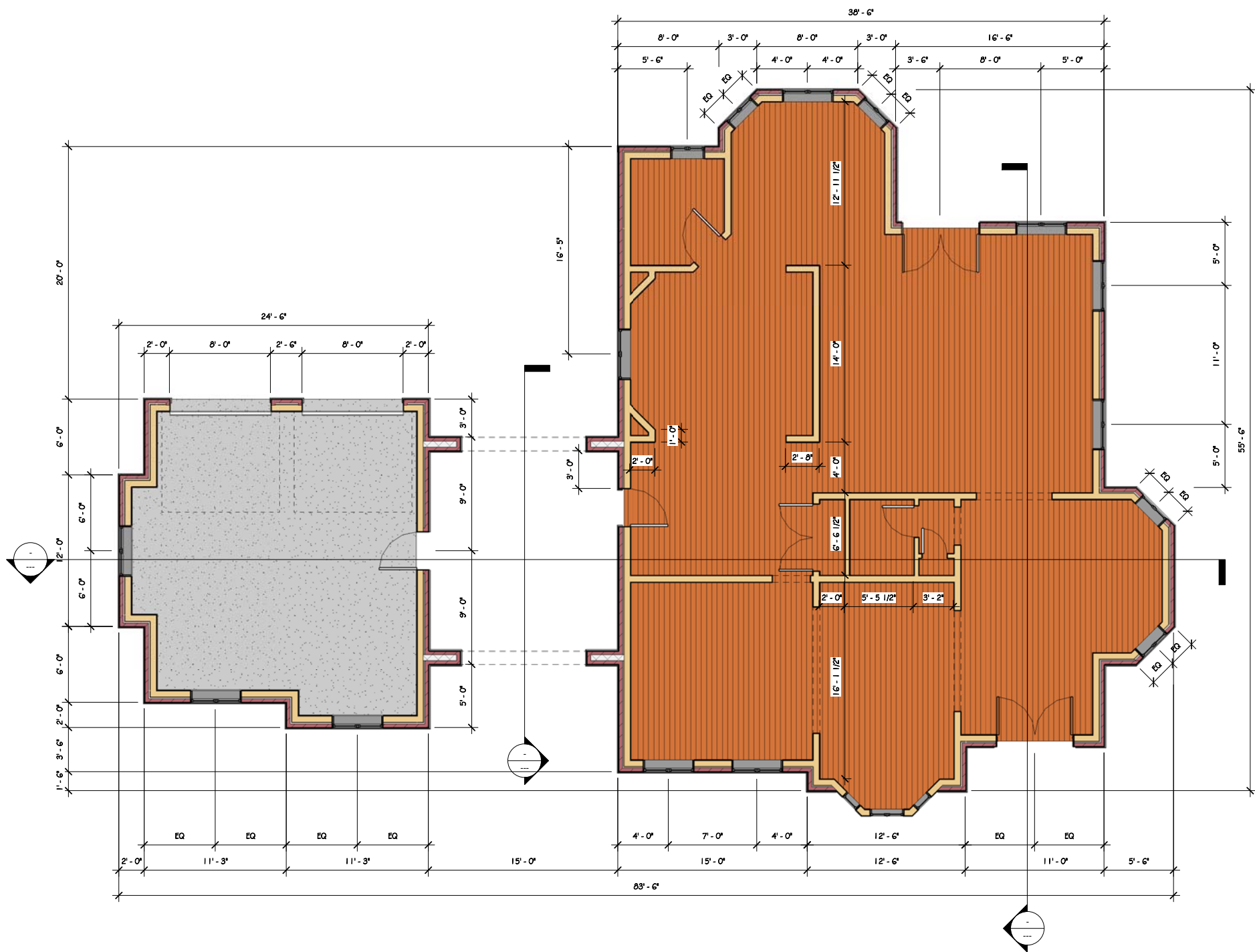
30. Save and backup your project. We'll start cutting holes in our beautiful floors in the next class when we work on adding the stairs. 😊

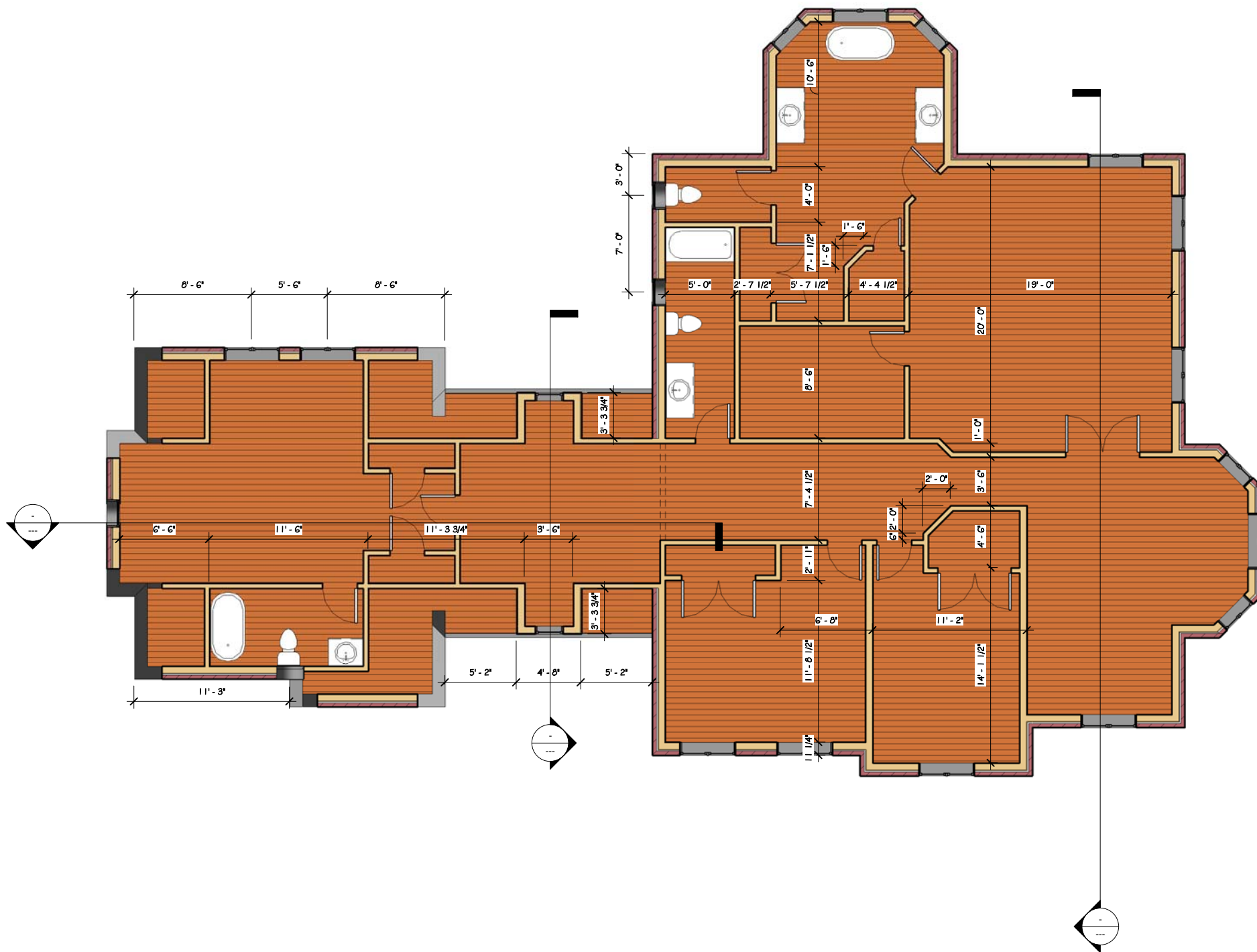




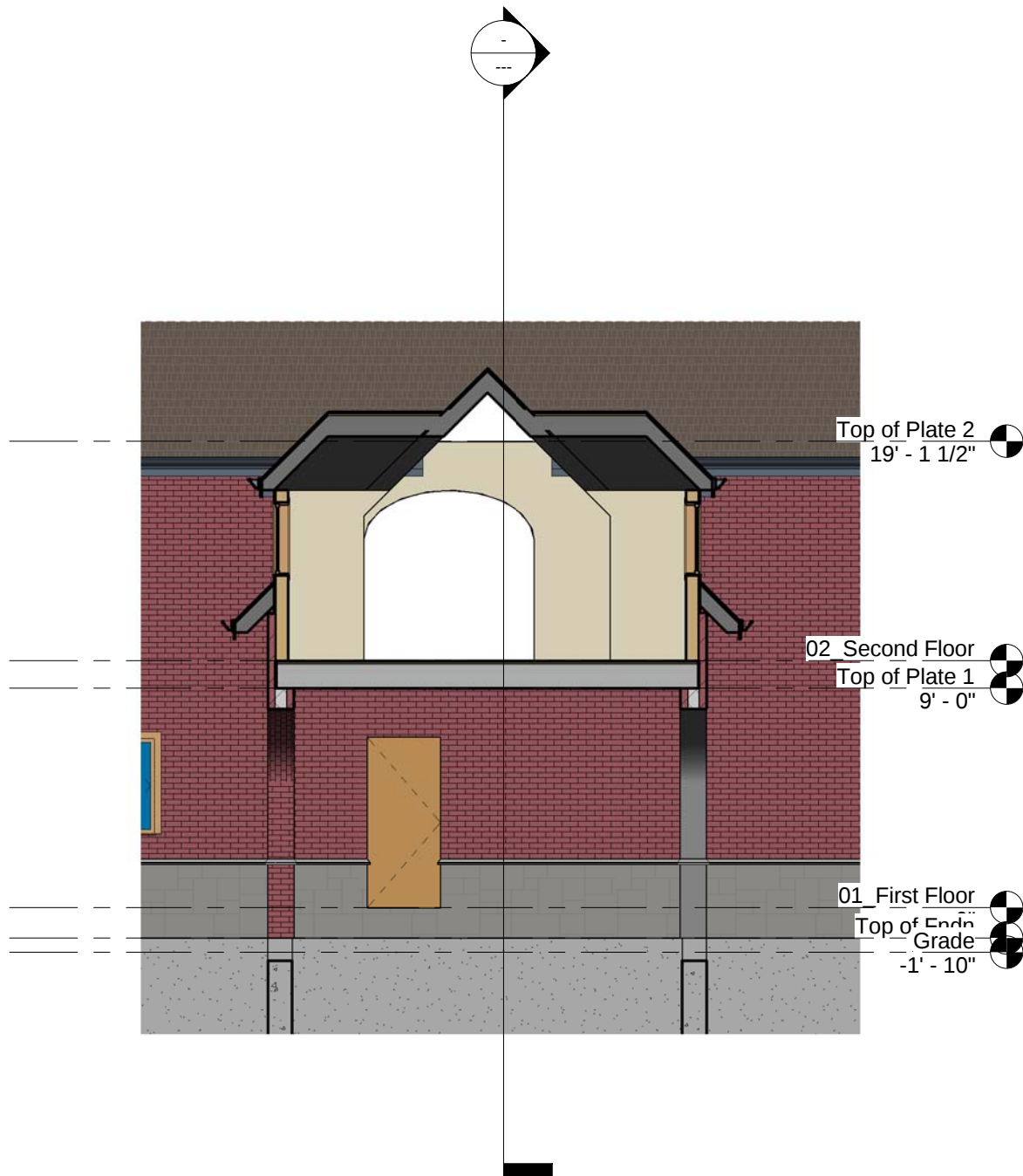












AGENDA:

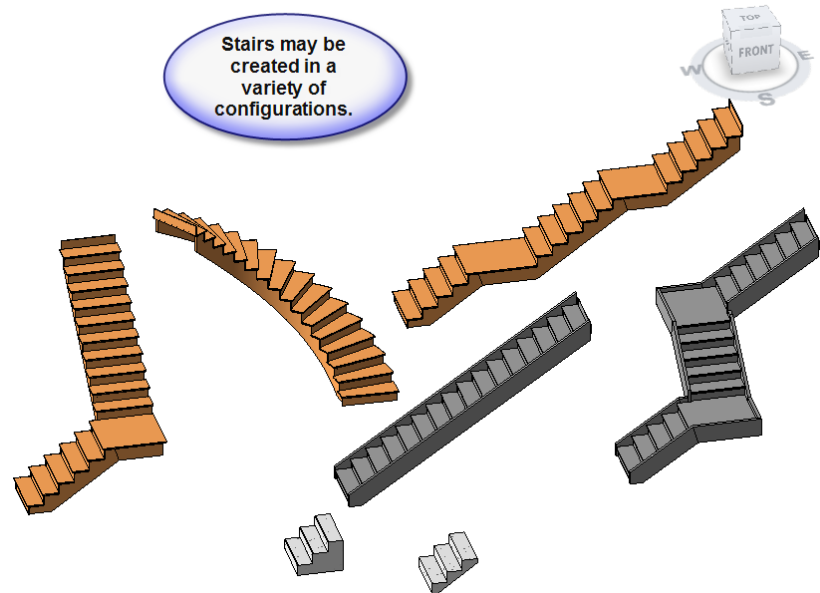
1. Introduction to Stairs and Stair Calculations
2. Creating Stairs by Components
3. Creating Stairs by Sketching

1. Introduction to Stairs

Revit allows you to create an endless variety of stair types through the use of several system families defining the critical parts used in stairs such as Runs, Landings, and Supports.

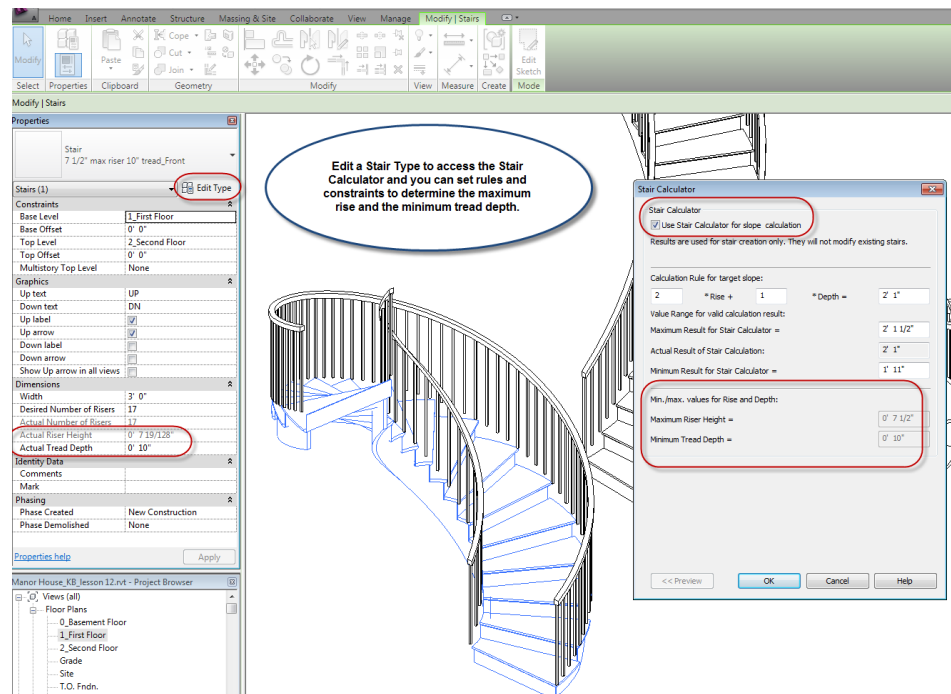
There are two main methods for drawing Stairs – Stair by Component, and Stair by Sketch. You can use the newer, Stair by Component method for virtually all types of stairs. It easily allows you to define a range of stair types from the simplest, single run of 2 steps to complex, multidirectional combinations of multiple runs and landings.

The Stair by Sketch method is the older method of stair creation and the only method prior to the addition of Stair by Component tools in the 2013 release. This traditional method allows for customization of stair and landing shapes by using sketching tools to draw the boundary and risers with lines and arcs.



Stairs may be generated as straight runs with or without intermediate landings, as L-Shaped or U-Shaped runs, in circular shapes, or in almost any other imaginable layout by using the custom boundary sketching method of stair creation. Railings may be automatically generated along with your stairs or you can create them separately using the Railing creation tool.

The Stair Calculator, available within the Type parameters for any stair, allows you to set rules for the allowable riser heights and tread lengths for your stair design. These values are linked to accepted ranges and formulas for creating a comfortable stair.



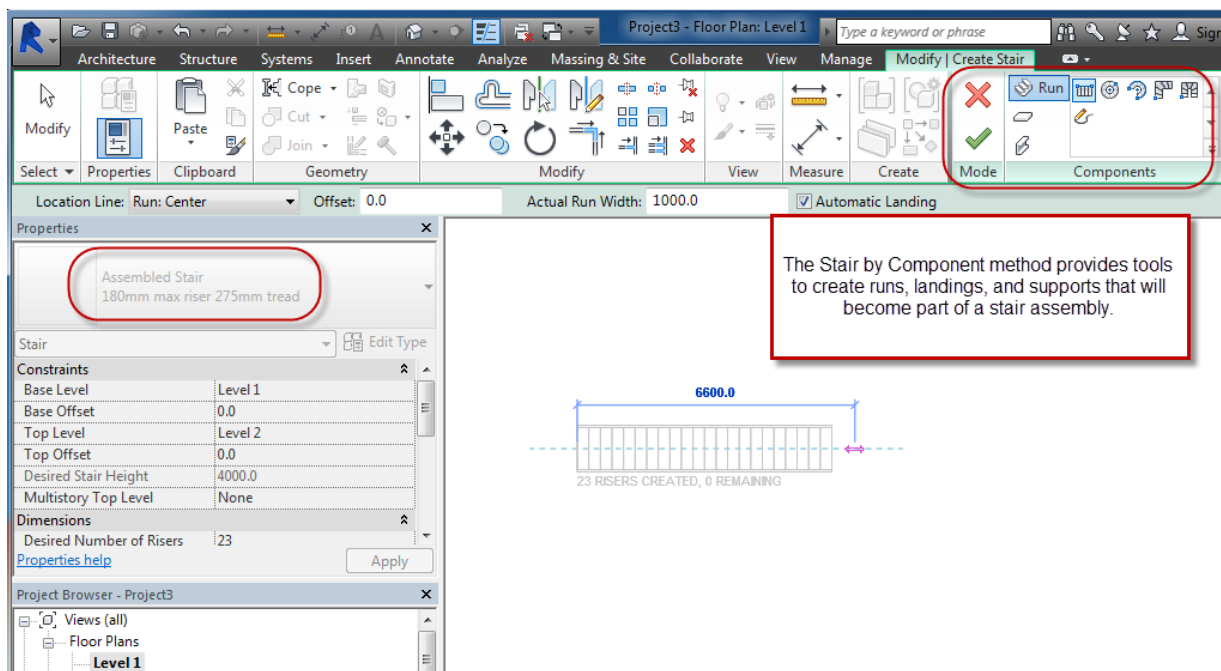
The rule shown here in the calculator as shown above is the classic $2R + T = 25$ or Two Risers plus one Tread should equal 25 inches. For a 7" riser height, the tread will be 11 inches. If you want your stairs to fit into a shorter length, you can use 7.5" for the riser and 10" for the tread. It still satisfies the comfort rule, it is likely just within the code limits for your area, and the stair will take up about 16" less space over the length of the stair.

Changing the calculation rules for a Stair Type does not affect existing stairs. Any changes you make here will be reflected in the next stair you create with that type.

When you modify the number of risers in an existing stair, the stair options bar will display a warning icon indicating the stair needs to be edited. Add or delete risers in the sketch environment to facilitate the changes specified in the properties palette.

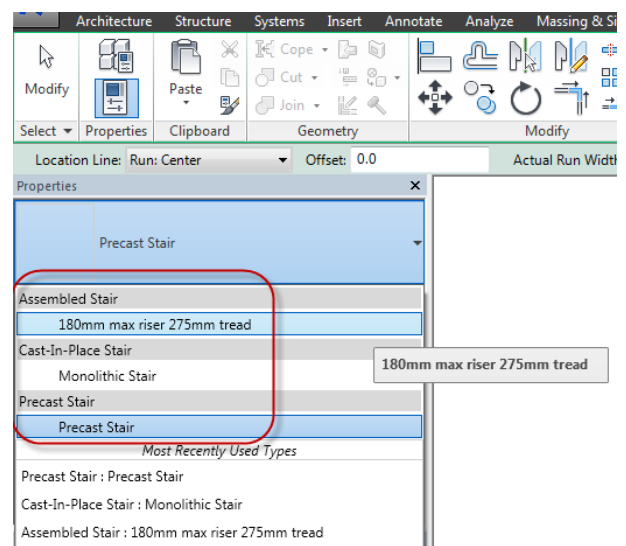
2. Stair by Component

The Stair by Component method allows you to create a stair assembly with common stair elements such as Runs, Landings, and Supports. Each of the three main components has its own system family definition and assignment within the main stair family. You can work in plan views and 3D views as required to create the defining components for any type of stair.

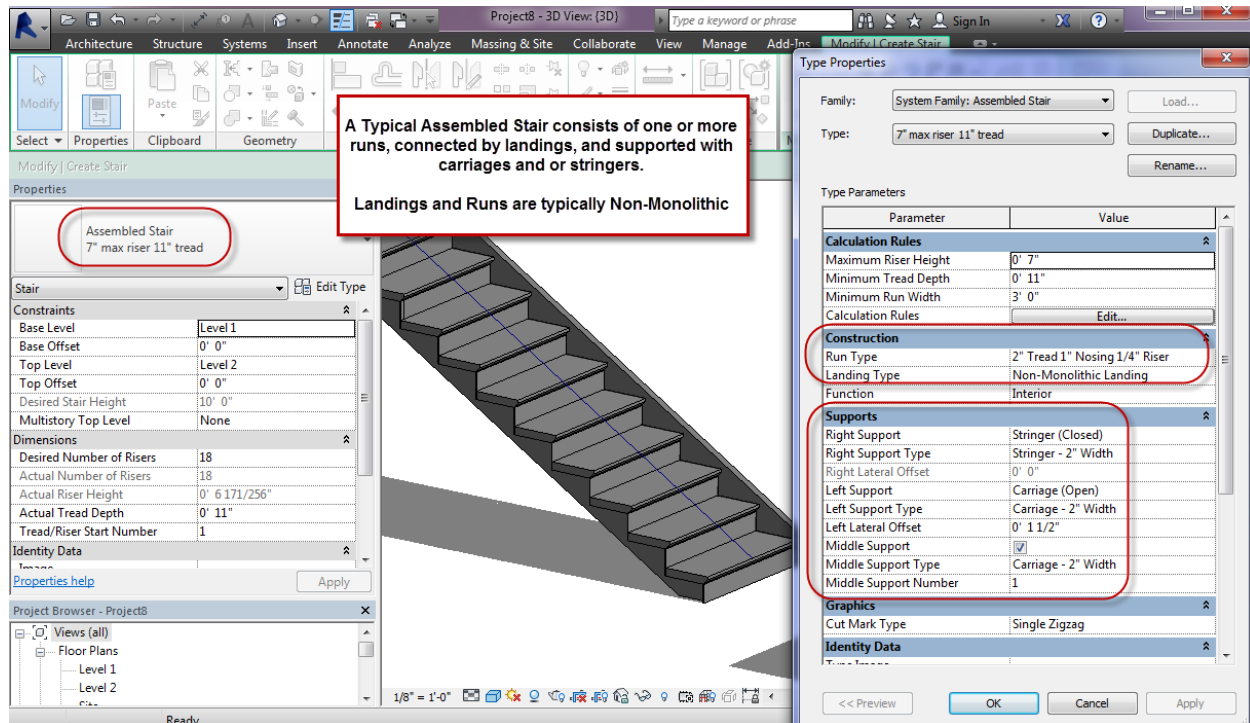


When you create a Stair by Component, you can select from one of three different system families: Assembled Stairs, Cast-in-Place Stairs, and Precast Stairs. These options show at the top of the Properties palette.

After selecting a stair family, use the tools in the components sketch area to define linear or curved runs. You can also use a Sketch tool which will allow you to manually draw a boundary and risers for more complex stairs.



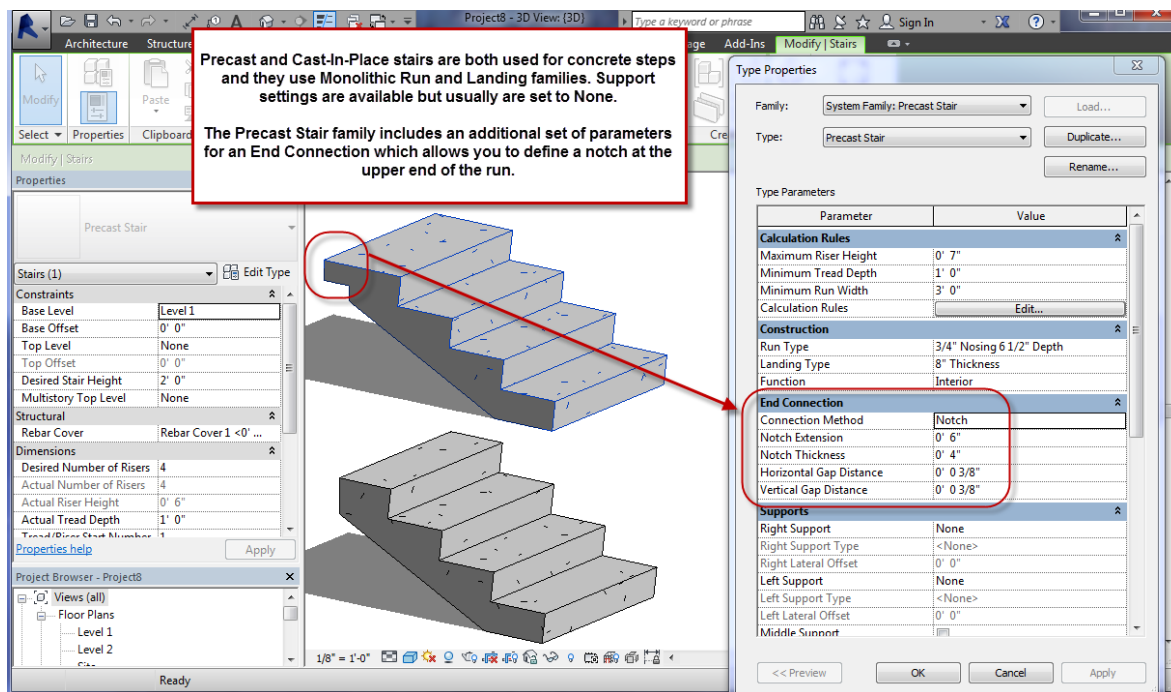
Assembled stairs are the typical stairs you would find in most homes and interior applications. They are usually constructed of wood in residential applications but this type of stair could also be created from steel for industrial or commercial applications.



When you access the Type Properties for the System Family: Assembled Stair, you will select a Run Type, Landing Type, and Supports. The Run type is typically defined with a Non-monolithic Run family with parameters controlling the size, shape, orientation, and materials for Treads and Risers. The Landing type is also typically defined with Non-monolithic Landing family with a Tread setting set to use the same values as the Tread parameters in the Run. If you clear the "same as run" option, you can set the tread parameters independently and vary them from the treads on the run.

Supports have their own category as well and again there are options to load a separate system family called a Stringer (closed supports), or a Carriage (open supports). Different types can be set for left, right, and middle supports. The Stringer and Carriage families allow you to define materials, set any profile to be extruded along the support run, and set options for structural depths for the support.

Cast-In-Place and Precast stairs are typically used for exterior stairs, especially for residential jobs, but may also be used in interiors for commercial or industrial applications. Cast-In-Place and Precast stairs are both created from concrete and are considered Monolithic stairs. They are not assembled from separate parts but are either poured on site or installed as a single, premade unit.



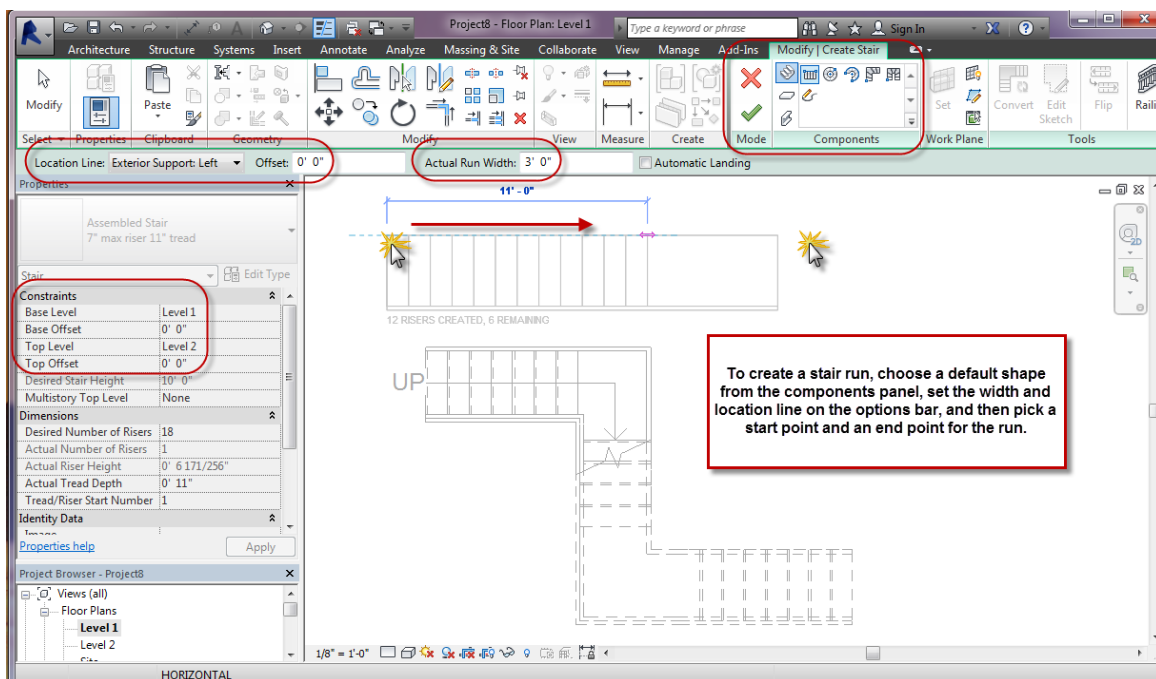
Cast in Place and Precast stairs both use the same set of Calculation parameters as Assembled stairs and both have Run Type and Landing Type parameters although these are typically set to Monolithic Run and Monolithic Landing families. Monolithic Runs and Landings have Tread and Riser settings but these are typically set to None. Construction parameters let you set a depth for the concrete and also assign a material.

Supports are available but are typically set to None for Cast-In-Place and Precast stairs.

Precast Stair families include one additional set of Parameters in an End Connection category. The connection can be set to Notch which will enable values for a notch extension and thickness. Setting the method to Straight cut will disable the notch dimension settings to create the same shape as found on the Cast-In-Place stairs. To use the Notch setting, you must turn off the End with Riser option for stair.

After selecting the desired family and type of stair you wish to create, and reviewing the type properties for Runs, Landings and Supports, check the Options bar to set the location line, offset, and run width, before drawing your first run.

The Run width defines the actual width of the treads and if the stair is using carriage type supports, the run width will be equal to the total width of the stair. If you are using stringer type supports, the stringer width will be added to the run width. If you are using 2 inch stringers on each side, and specify the run width as 3'-0", the total width of the stair, including the supports will be 3'-4".



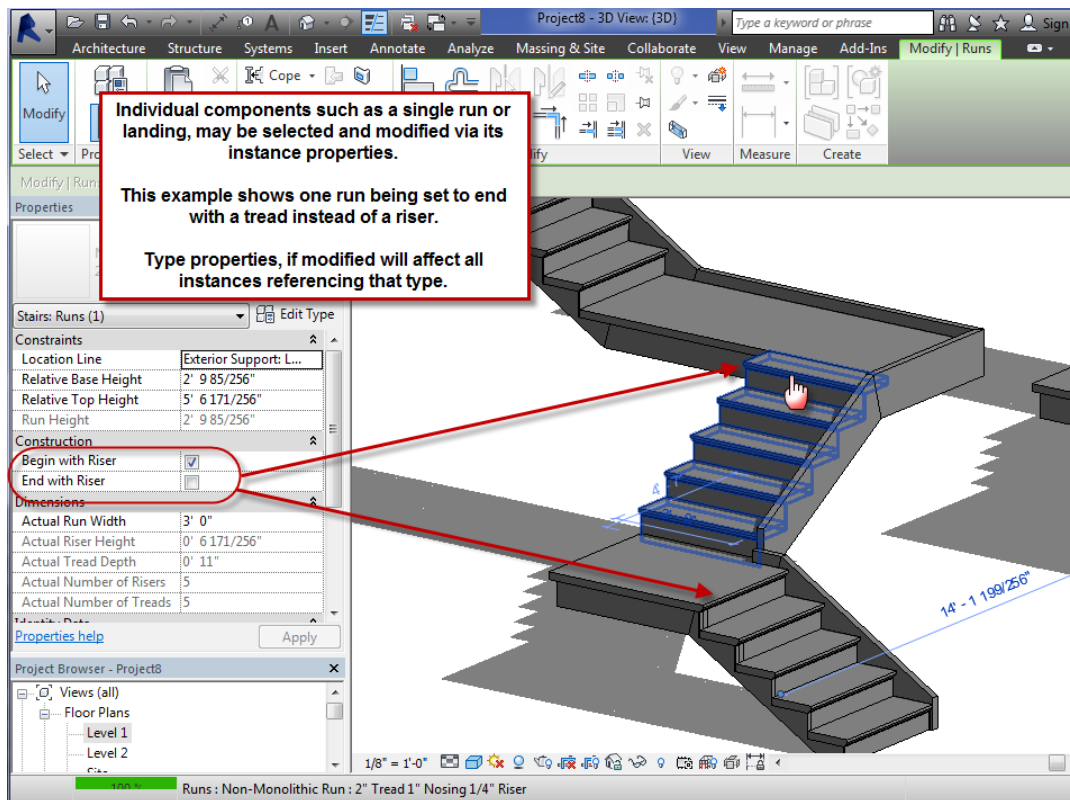
The location line defines where the stair will be attached to your cursor as you pick points. Pick a start point and drag your mouse in the direction of the run and risers will be added automatically with text showing how many have been created and how many are remaining. Pick a second point beyond the extents of the run and a full straight run will be generated.

If your stair will have an intermediate level between runs, you can create a landing between runs by selecting the Automatic Landing option on the Options bar. Each run of stairs will be defined with two picks at the start and end points. Landings will be intelligently connected between the end of one run and the start point of the next run.

The instance properties let you set the Base level and Top level for the stair as well as the desired number of risers and actual tread depth. The Riser height will be calculated automatically by dividing the number of risers into the overall stair height. The minimum tread depth and maximum riser height defined in the type properties will limit the values you can specify in the instance properties.

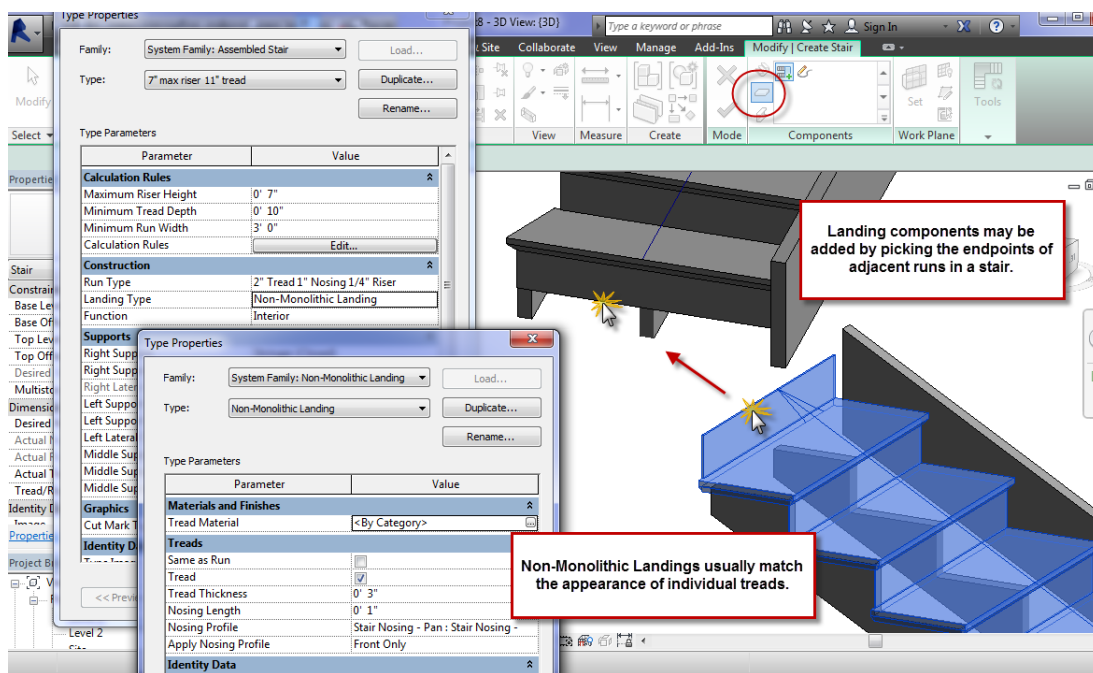
Some changes to the properties for a stair, such as modifying the number of risers or changing the overall height of the stair will also require that you edit the stair in a plan view to adjust the length of a run and remove extra risers.

All of the components that make up a complete stair may be individually selected and modified, even when the stair is not in edit mode. Use Tab Select to pick individual components within a stair.



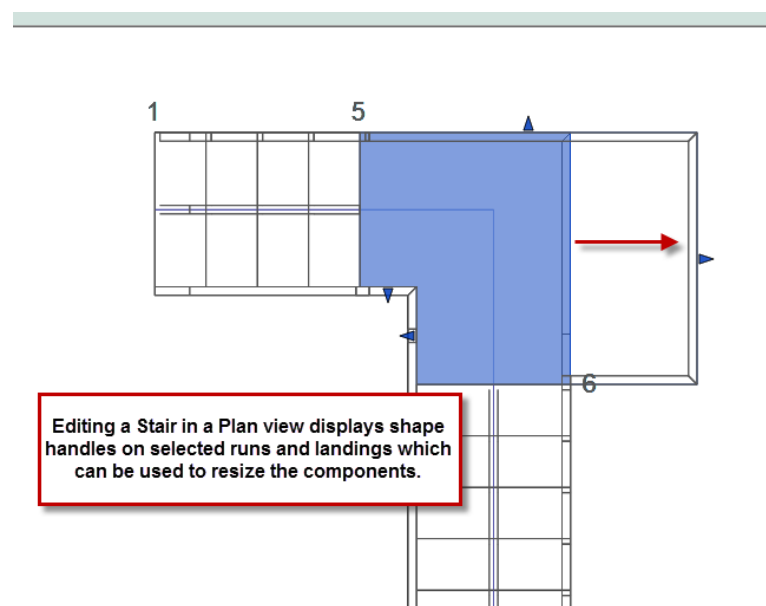
The End with Riser setting allows you to control whether a full tread is added at the top of each run. Normally, end with riser is turned off, which will reduce the overall space requirements for a stair. The landing or the upper floor will act like the top tread in a run.

Landing Components may be added manually with the landing component tool while creating or editing a stair. Common, rectangular landings may be added by picking the top of one run and the bottom of the next. The landing properties will match the run properties by default but may be accessed and modified independently via the Landing type family parameters.

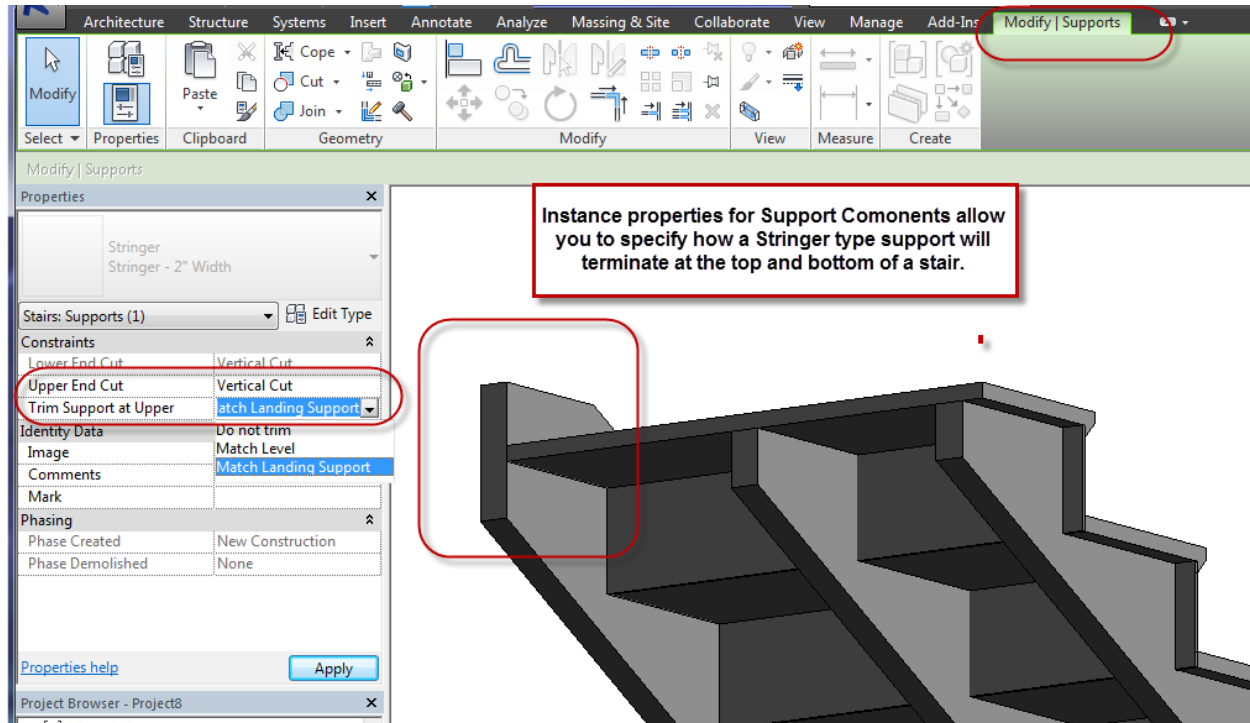


While adding landings or modifying runs or landings, you can work in a 3D view or in a Plan View. Plan views will provide more controls, allowing you to adjust the positions and sizes of runs and landings with temporary dimensions.

Selected landings or runs can be resized or reshaped by dragging shape handles.



Support components use either a Stringer system family or a Carriage system family. Outside supports may be set to None, Stringer, or Carriage on the left, right, or both sides. They can vary on the two sides.



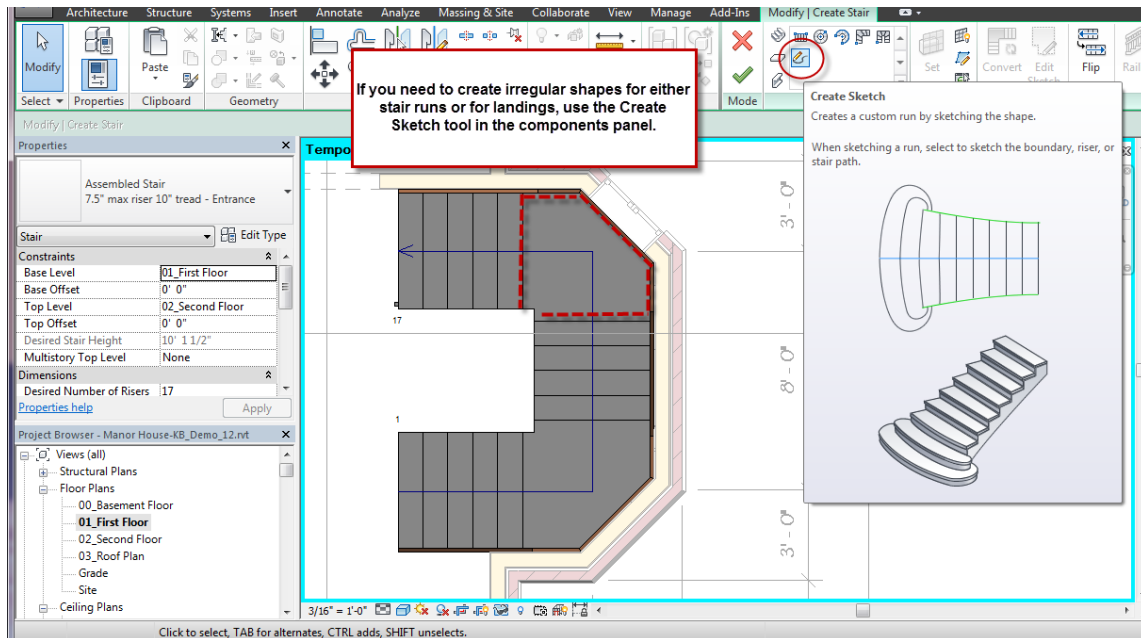
Stringers support the stair treads at one or both sides of the stair. Stringers are closed supports, which will house the tread ends behind or inside a continuous support member. Carriages are open supports, in which the ends of the treads will be visible over a stepped support member.

Middle supports, if enabled, always use the Carriage support type and may be added in the middle of the stair width. These supports are always notched and their thickness will be set by the Carriage type's thickness value. You can choose to enable multiple middle stringers and as you increase the number, the stringers will be equally spaced over the width of the stair.

Lateral offset values are only available when the support type is set to Carriage. The offset allows you to set the length of the overhang for the treads over the sides of the stringers. A distance of zero means the stringer will be flush with the tread end.

Creating Stairs by Sketching Components

When you need to create an irregular shaped stair or if you need more control over the exact placement of your stair components, use the Create Sketch tool on the Components panel to draw the edges of stringers and risers exactly where and how you want them to appear.



Create Sketch will appear for both runs or for landing components and may be combined with common components. You can have two straight, common runs branching off a sketched landing for example.

Sketch tools let you draw the boundary for a landing component, or the boundary and risers for a run component. For a more complex shape it is more useful to first draw the boundary lines and then add the riser lines where you need them.

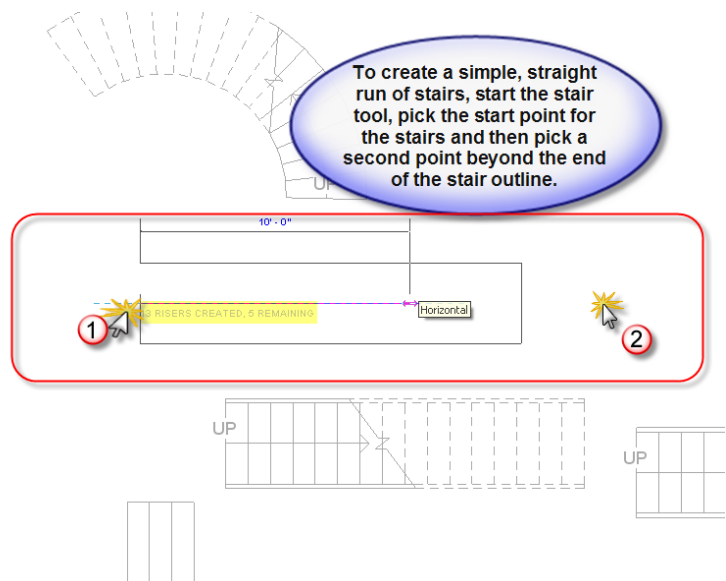
You can start sketching a run and draw the entire stair at the same time. The landings are really just oversized treads so you can do both at the same time. Boundary lines need to be split at the end of each run so the supports will change direction and remain parallel to the run and landing portions.

Risers as well as Boundaries support curved as well as straight edges although for very elaborate conditions, especially curved ones, you may need to do some in-place modeling.

3. Stair by Sketch (Pre-2013 Method for Stair Creation)

In older versions of Revit, the Stair by Sketch tool was the only way to define stairs. In current releases, all of the sketching tools from the original stair creation tool have now been incorporated into Stair by Component. To use Sketches in stairs, the best method is to start the Stair by Component tool, and then choose the Create Sketch option from the Components panel.

In an older version of Revit, to Sketch a run of stairs, select the Stair by Sketch tool and then pick two points to define the start point for the stairs and the end direction for the stairs. After you pick the first point and start to drag your mouse towards the end of the stairs, an outline will appear showing you the overall length of the stairs. A line of text will also appear inside or beside the stair boundary indicating how many risers will be created and how many will remain to be added if you pick a point.

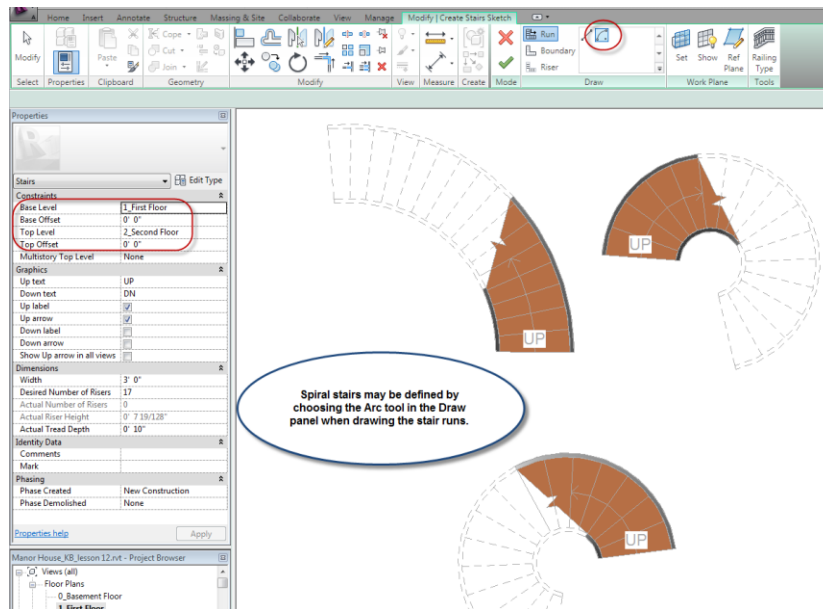


When you sketch a run of stairs, picking the second point any distance beyond the stair boundary will define a full, straight run of stairs. If you pick a point within the boundary, it will define the endpoint for the initial run and the start location for a landing. The next point you pick will define the endpoint for the landing and the start point for the second run of stairs. A second rectangle will appear showing you the potential length of the second run and the riser note will update again to show you how many risers have been created and how many remain to be drawn.

When you define an intermediate landing in your stairs, you can change the direction of the second run by dragging your cursor in the desired direction. To create a U-Shape stair, drag your cursor back in the direction of the initial start point. More than one intermediate landing may be added to a stair by specifying additional landing points within the stair runs.

Spiral Staircases may also be defined with the Run method by starting the Stair tool and then picking the Arc from Center and Endpoints button on the Draw panel of the Ribbon.

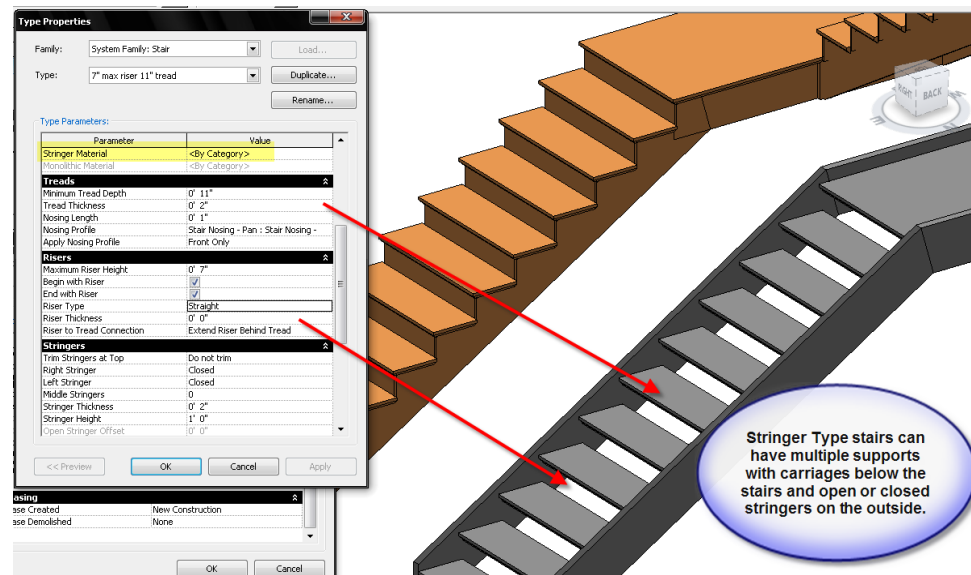
Spiral staircases created with Stair by Sketch, cannot turn through a full 360 degree circle or a greater included angle. The size of the stair and its included angle is a function of the center radius specified along with the floor to floor height as well, as the actual rise and run calculations for the stair. As the radius of the stair gets larger, the included angle will decrease.



Spiral stair runs are created by default as continuous runs but they do support intermediate landings if you specify a common center point for the first and second run.

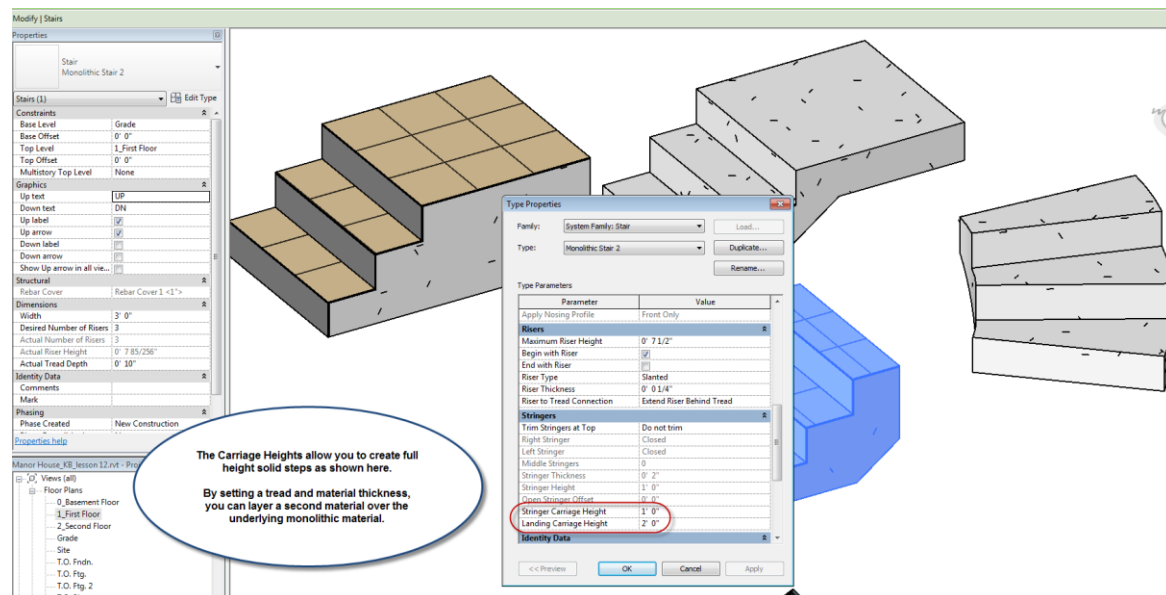
When you sketch a run of spiral stairs, the first point you pick defines the center of the stair. The second point defines the radius to the middle of the stairs as well as the start point for the stair. As you drag your mouse away from the start point of the stairs, the direction will specify the stair as Clockwise or Counterclockwise and you can drag in the opposite direction to reverse the stair direction. As you drag your mouse through the arc run, the riser note indicates again how many risers have been created. If necessary, use the Move and Rotate tools to shift and orient the finished stair in the correct position.

Tread and Riser Stair types are the typical interior stairs that we are used to seeing inside most homes and offices. When you disable the Monolithic stair property, Stringer parameters become available.



Set the Riser type to None to disable risers in the stair as well, a feature common to steel stairs.

Monolithic Stair types are typically used to represent solid, concrete steps. These stair types have a zero thickness tread and Riser and by default have a monolithic material applied uniformly over the stair object.



It is possible to set material finishes for the both the riser and tread components if you change the thickness for these elements. Set the thickness to the depth of the finish material, and assign explicit materials to the Riser or Tread component as required.

Instead of Stringer supports on the sides of the stairs, Monolithic stairs created with the By Sketch method use only a Carriage support. The thickness is automatically set to the width of the stair. The depth of the stringer below the treads and risers is controlled by the Stringer Carriage Height.

To have your stair extend all the way to the base level, set the landing Carriage height to be equal to the overall stair height.

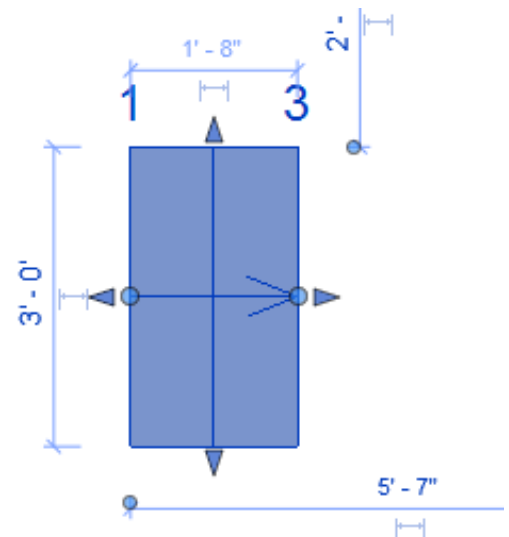
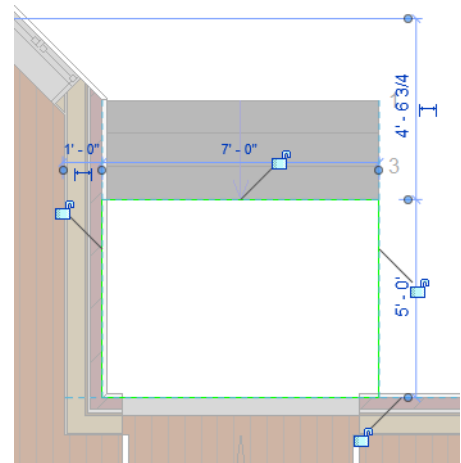
Landings are created at the tops of sketched monolithic stairs by editing the sketch and dragging the top riser line to the depth of the landing. The landing is just a wide top step on the stair. Add segments to the boundary as well to create an offset or custom landing.

Exercise Notes

In the following exercise you will create several stairs in the Manor house project and add floor openings where required.

1. Open the Manor House project and switch to the first floor view. Zoom in to the back of the Great room at the exterior door. From the Circulation panel on the Ribbon, pick Stair by Component. On the ribbon, pick the railings control panel, and set the railing type to None.
2. In the Properties palette, choose Cast-In-Place Stair: Monolithic Stair. Pick Edit Type. Duplicate and create a new type called Concrete Step 1. Set the minimum tread depth to 10" and the maximum riser height to 7 ½". In the Construction settings, set the Function to Exterior.
3. Pick the browser button by Run Type. Duplicate the Run type and create a new one called Straight Riser. Under Treads, set the Nosing length to 0". Set the Riser type to Straight by clearing the Slanted option. Pick Ok twice.
4. Set the Base level to Grade and the top level to First Floor. Set the Desired number of Risers to 3 and the actual tread depth to 10". Leave the Width at the default 3' 0". Check the riser height. Change the number of risers to 4 and apply. Change it back to 3 again and apply. Toggling the number of risers in the stair will ensure that the riser heights are calculated correctly.
5. On the options bar, set the Location Line to Exterior Support: Left. Pick a point at the corner of the wall to the left of the double doors. Drag your mouse up and pick beyond the extents of the stair.

6. Pick the stair run and use the shape handle to drag the width to the far side of the doors. Pick the temporary dimension and set the width to 7'-0". Pick the green arrow on ribbon to finish stair.
7. Notice the DN (down) arrow is pointing towards the house. Pick the stair and then pick the flip arrow so the DN text appears by the door and the arrow points away from house. Switch to a 3D view and zoom in to the new stair at the Northeast corner of the building.
8. To make the step solid all the way to the ground, we can increase the structural depth. Pick the stair and open Type Properties. Edit the Straight Riser run type. Rename to Straight-Riser-Full-Height. Set the structural depth to 1'-10" to match the distance from grade to first floor level. Pick OK and close Type properties. Finish editing the stair.
9. Switch back to the first floor view. Move the stair 5 feet to the north so the front corner aligns with the corner of the 45 degree wall. Pick the stair and then choose Edit Stair on the ribbon. From the Components panel on the Ribbon, choose Landing and then Create Sketch. Draw a 5 foot by 7 foot rectangle with one edge aligned with the top riser on the stair run. Finish the Sketch. Finish the Stair Edit.
10. Switch back to the 3D view. If the landing is not solid all the way to the ground, edit the stair, duplicate the landing type, and create a new one called Full Height that uses a monolithic thickness set to 1'-10".
11. Switch back to first floor and zoom in by the side door under the porte-cochere. Add a second instance of the Concrete Steps as a single run with no landing, centered on the side door. Turn off the automatic landing option. Use the default width of 3'-0" and a top constraint at the First Floor level. Pick the stair run and in the instance properties, select the "End with Riser" option. If the riser numbers now display 3+1 instead of 3 at the top end, pick the stair and then use the circle control grip at the end of the stair path to drag the run back towards its start and remove the top riser. The stair should now 3 risers and 2 treads as shown here. Finish the stair and then move it into position, centered on the side door.

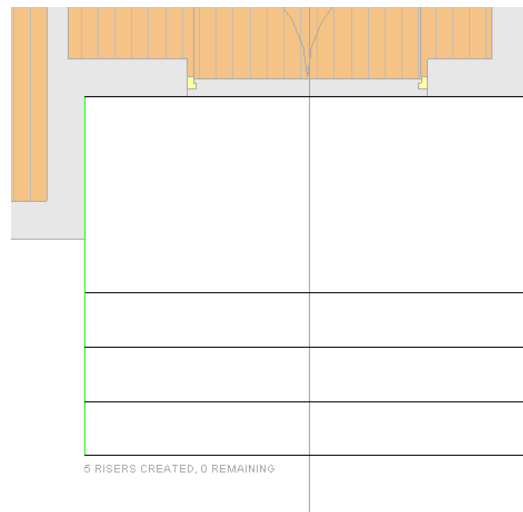


12. Create a third stair at the main front entrance. This time we will use a different method. Start the Stair by Component tool, in the Type Selector, choose Concrete Step 1, and then access the Type properties. Duplicate the type, creating a new type called Stone Steps – Entrance. Edit the properties of the new stair type and set the Minimum tread depth to 1'-1" and the Maximum Riser Height to 6". Set the Landing type to Full Height.

13. Duplicate the Run type and make a new one called Straight Riser-Full Height-Tiled. Turn on the Tread and Riser and set their thickness to ½". Set the nosing length to zero. Change the Tread material from By Category to a new material showing a stone or tile appearance. I brought in Tile, Quarry from the AEC material library. Please note that all custom materials imported from the library should have their texture dimensions review and modified for accuracy. Assign the same material to the Riser and Tread. Pick Ok.

14. Set the base level to Grade and the top level to first floor. Set the desired number of risers to 4 and the actual tread depth to 1'-2". (The rise should work out to 5 ½)

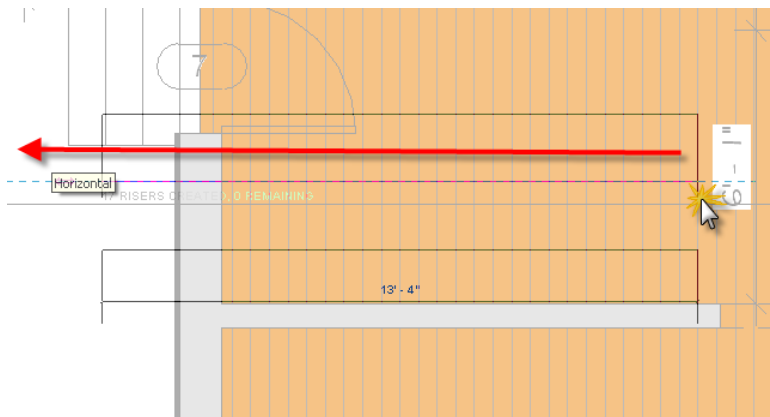
15. Pick the Create Sketch tool in the components panel and then draw the boundary edges and risers as shown. Set the landing depth to 4' 10" and then offset the remaining riser lines at 1'2" spacing. Add an extra riser line along the wall at the end of the landing. Add two more boundary edges at the ends of the risers. Pick Ok and Finish the stair. Accept any warnings and then Tab select the run in the stair and in the instance properties deselect the End with Riser setting.



16. Pick Finish to complete the stair. Take a look at your new stair in a 3D view. Set the shading to realistic so you can see the stone or terracotta tiles you have added. Adjust the material if required.

17. Switch to the first floor view. We'll do a straight stair first, to warm up. ☺ Zoom in to the wall between the dining room and the side entrance. Start the Stair by Component tool. In the type selector pick Assembled Stair 7" riser 11" tread and pick Edit Type.

18. Duplicate the 7" max riser, 11" tread type and create a new stair type called 7 ½" max riser 10" tread. Pick the browse button by Run Type and duplicate and create a new type called 1" tread 1" nosing ½" riser. Set the Tread material, Riser Material, and Stringer material to a wood material of your choice. Set the tread thickness to 1", the riser thickness to ½", and the Apply Nosing Profile to Front and Right. Pick OK.
19. Set the Right Support to Carriage (Open) and the left Stringer to Closed. Duplicate the Support Types and make a new Carriage Support and Stringer support with the width set to 1 ½". Set the Total depth to 11 ¼", and the structural depth to 3 ½". Set the Depth at landing to 7 ¼". Pick Ok. Pick Ok and review the instance parameters. The Base level should be 01 First Floor and the Top level should be 02 Second Floor. The Desired number of risers should show 17.
20. On the options bar, set the Location line to Exterior Support: Left, and the Actual Run Width to 3'-0" Pick Ok and drag out the stair from right to left in a single run. Pick Finish sketch.
21. Use the align tool to move the stair against the wall and 6 inches over from the opening to the Dining Room. Zoom Back out a bit and you should see the Section 1 section line running through the stair. Double click the section head to switch to the Section 1 view. Zoom in around the top of the stair and check for a top tread overlapping the floor system. If so, edit the stair, pick the stair run and in the Properties palette select the End with Riser option. Pick the shape handle by the top riser and drag it back towards the start of the stair until the stringer changes and the top step is removed. Pick Finish to complete the edit and create the stair.
22. At the top of the stair, you can see the stringer support extending above the floor. Pick the stair, pick edit stair, pick the support stringer, and in the properties palette set the Trim Support at Upper to Match Level. Apply and then Finish the stair edit mode.



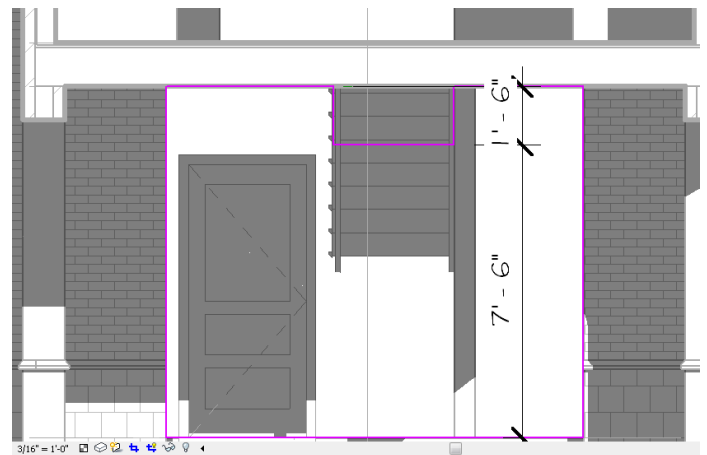
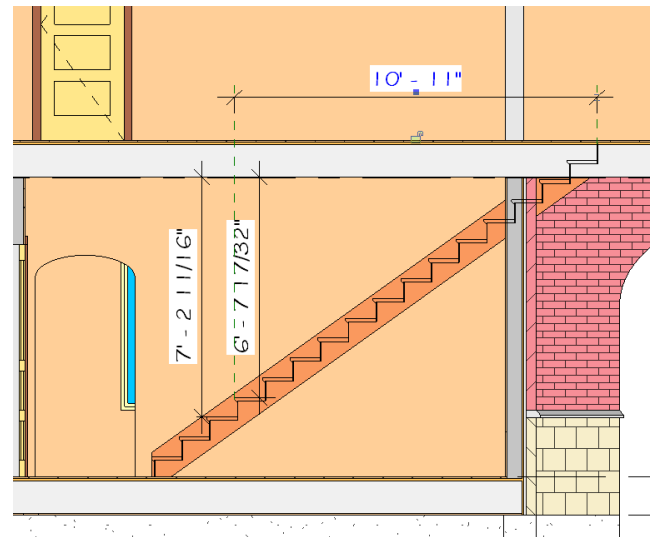
23. Use the section view to help determine the location for the hole you need to cut in the floor for a stair opening. Draw dimensions from the steps to the underside of the floor above to get an idea about the headroom at different locations. Draw two reference Planes to act as guidelines for you when editing the floor.

24. Switch to the second floor view and zoom in around the stair location. The dashed green lines are the reference planes you added in the Section view.

25. Move your cursor over one of the exterior walls until the floor highlights. Pick it and choose Edit Boundary on the Ribbon. The stair and reference lines should both be visible making it easy to trace a rectangle over the stair. I decided to move the reference line out to the 7'2" headroom after seeing the available space on the second floor. Pick Finish Sketch to add the stair opening.

26. Switch back to the Longitudinal Section View so you can see the stair opening. Where the stair cuts through the wall. In this area we're going notch a section out of the exterior wall and later build a bulkhead around this stair where it passes through the exterior in the porte cochere. Again, drawing a dimension in this section view will make it easier to determine the depth of that notch in the wall profile.

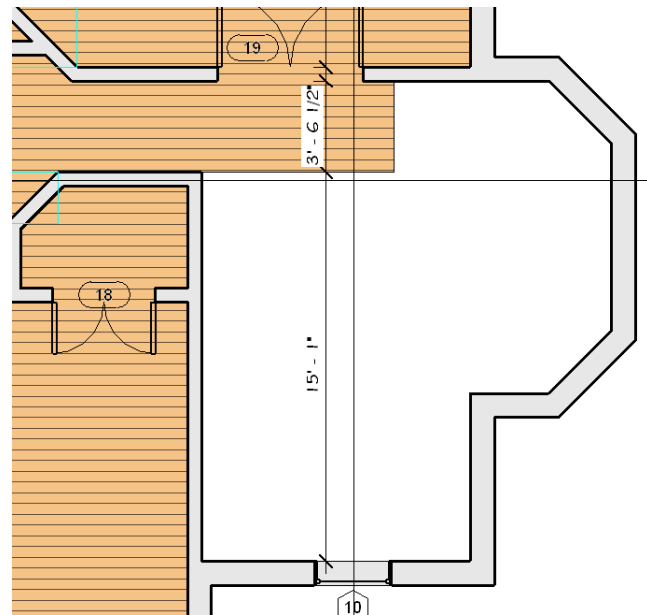
27. Select the wall and choose Edit Profile. Select the Dormer Section view to use to edit the profile as it is already cutting through the passage. If section 2 is not available, switch to the second floor view, flip the section in the direction of the house and then switch to that view and start the wall edit profile again. Add the notch as shown above. Switch to various views to examine the connections. Orient a 3D view to the Section View so you can easily get back to this view for later edits.



28. Switch to the Second floor view. Edit the floor perimeter around the front entrance area to make room for the stairs and Foyer opening. Don't worry about the exact dimension for the edge at the top of the stair as we will fine-tune it after the stair is created.

29. Select the Cross Section section line and flip its direction so it is looking towards the bay section where we'll create the main stair. Reduce the extents of the section.

30. Switch to the First Floor view. Because this stair is very complex with three separate runs and



two custom, angled landings, we will use the Sketch tools inside the Stair by Component method.

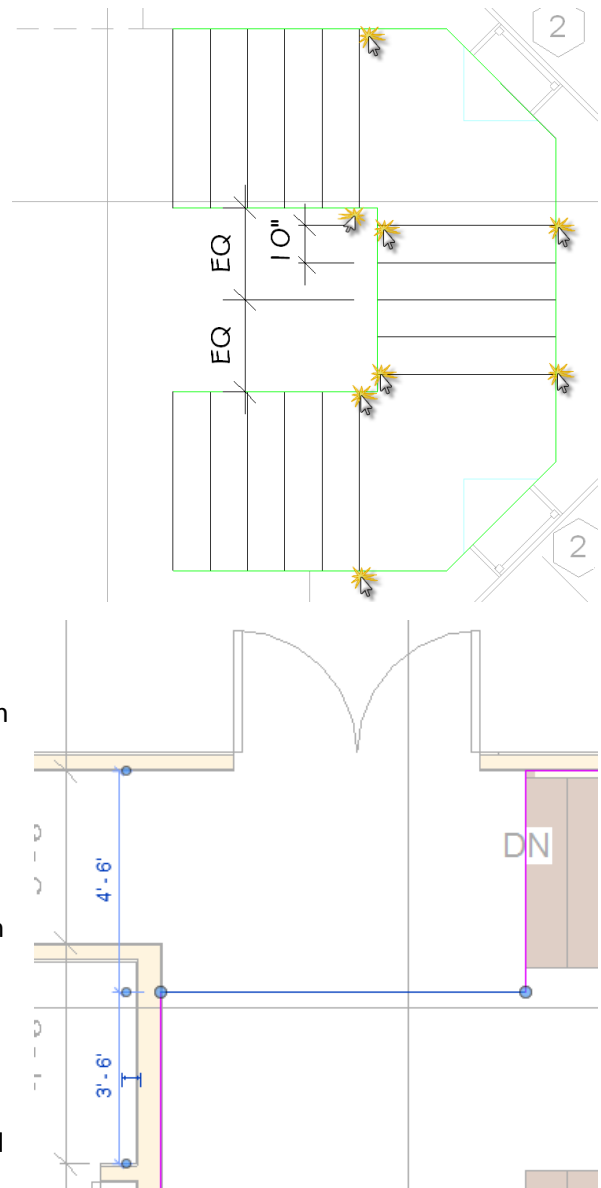
31. Start the Stair by Component tool. Duplicate the 7.5" max riser, 10" tread type and create a new stair type called 7 ½" max riser 10" tread-Entrance. Duplicate the Run type and set the Apply Nosing Profile to Front and Left. Under Risers, change the Riser to Tread connection to Extend Tread Under Riser. Pick Ok.

32. Under Supports, set the Right Support to Stringer (Closed) and the Left Support to Carriage (Open). Set the Stringer thickness to 1 ½". Set the Stringer height to 11 ¼". Set both support types to the 1.5" width variations you created for the back stair. Pick Ok.

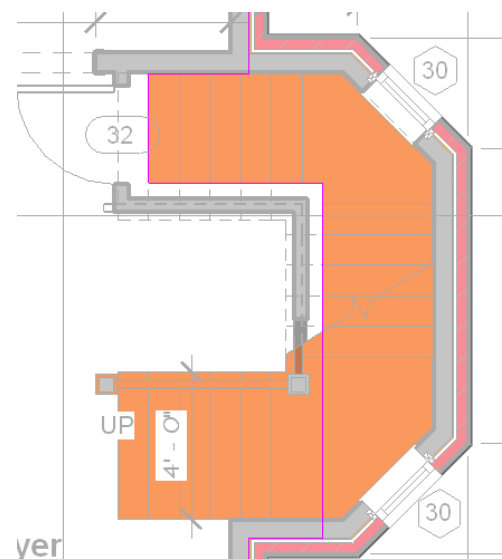
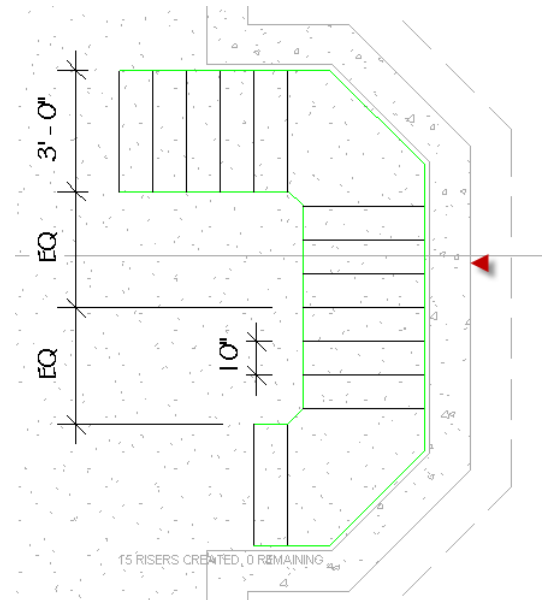
33. In the Properties Palette, set the Base level to 01 First Floor and the Top level to 02 Second Floor. Confirm the Desired number of risers is set to 17 and the actual tread depth is set to 10".

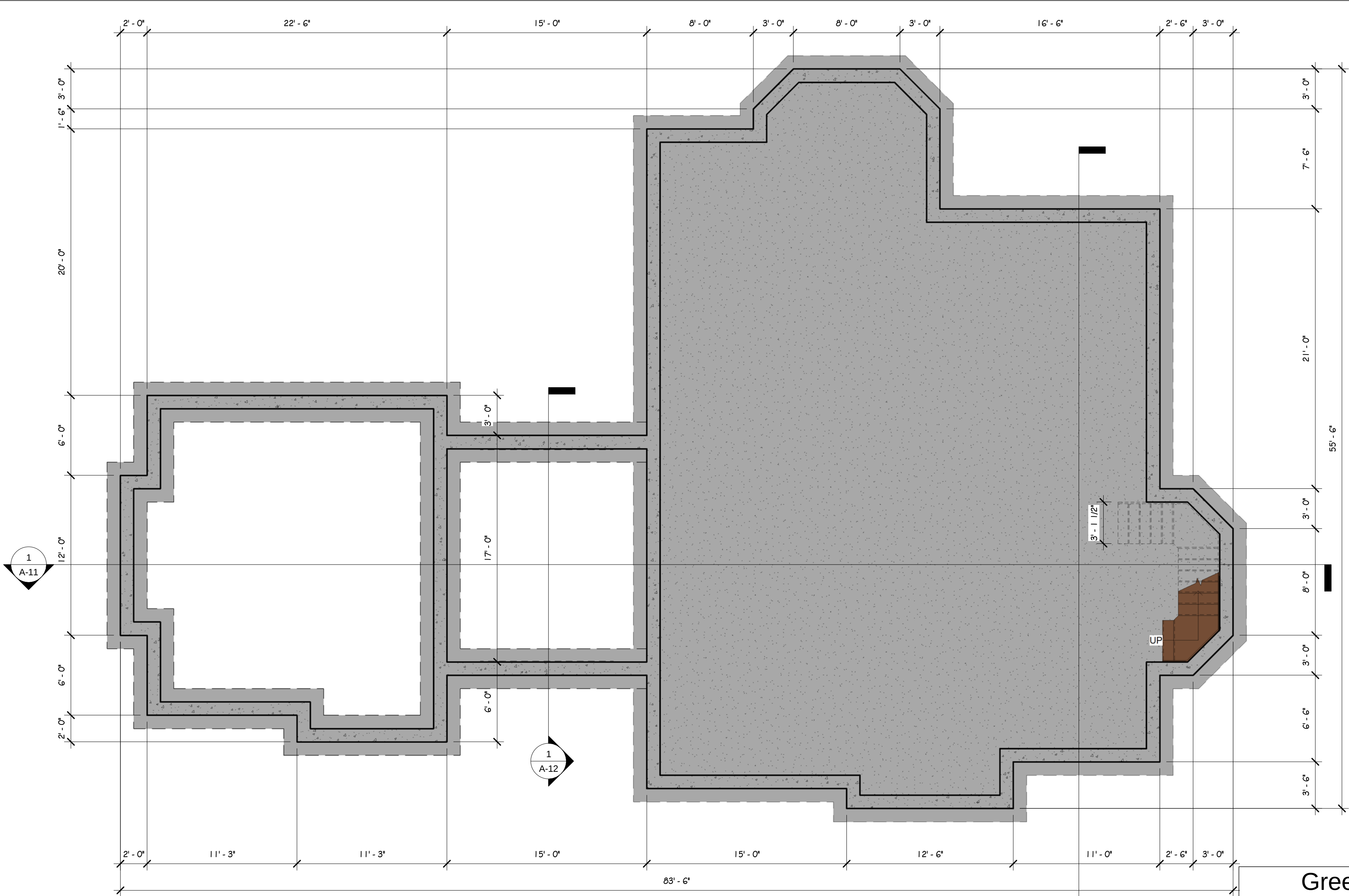
34. With the Run Component selected, pick the Create Sketch tool in the components panel. With Boundary selected, set the Offset to 1.5" on the Options bar, and use Pick Edges to select the edges around the bay. Offset the horizontal and vertical boundary edges in 4 feet towards the inside and trim the corners. The edges next to the wall are offset in 1.5" to allow space for the 1.5" stringer.

35. Select Riser on the Draw panel and use the line tool to draw the first riser line from the midpoint of the short vertical boundary and then start offsetting the riser 10". Check the distance from the top riser in the middle section to the turn and then match that distance to the first riser on the adjacent flights of stairs. Offset the remaining risers.
36. Draw the boundary in separate segments or use the Split tool to break the boundary into sections at the ends of each landing as shown in the image at right.
37. Select the Stair Path tool on the draw panel and add a series of three lines from the bottom of the stair, thru the landings, and ending at the top riser. Pick Finish sketch. In the properties palette, select End with Riser and apply. Pick Finish Edit Mode to create the stair.
38. Switch to the second floor view and edit the floor perimeter as shown here. Finish the Sketch and switch to a 3D view. Orient the view to Cross Section. Swivel the view until you have a good look at the new stair.
39. Select the Section box and use the control arrows to adjust the width of the view so you can see the curved portion of the top landing. Right-click on the view cube and choose to Save the view. Name the new view Entrance Hall. Select the stair and hit CTRL-C or pick the copy to clipboard icon. From the Edit menu, choose Paste Aligned – Select level by name and then pick the basement level and pick OK.
40. Switch to the Basement view. With the new stair in the basement selected, modify the Stair properties and change the top offset to 0". The number of risers will change from 17 to 15. Set the Desired number of Risers to 15 as well.



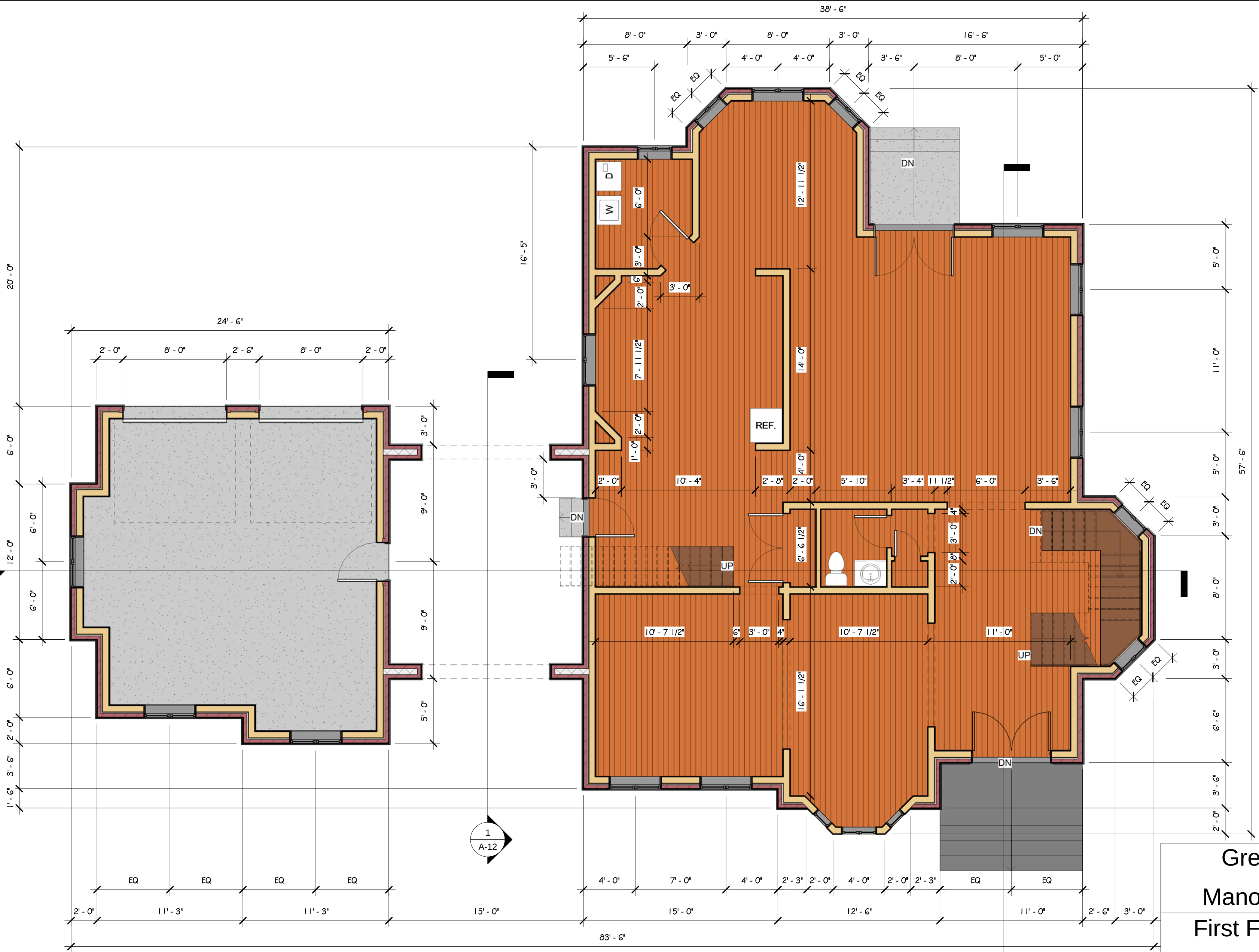
41. With the stair still selected, pick Edit Stairs. Pick the stair run and then Edit Sketch from the tools panel on the Ribbon. Modify the sketch of the basement stair as shown at the right. Adjust the width to 3 feet first and then delete the top riser. Start offsetting new risers where required and drag the ends of the boundary lines to the risers.
42. Adjust the split positions defining the landing locations and then finish the sketch.
43. Switch back to the First floor view. Select the floor and pick Edit. Modify the perimeter of the floor to create an opening for the basement stair.
44. Switch to the entrance hall view and orbit the view until you can see the inside of the exterior walls where they connect to the foundation. Select the walls, duplicate their type and create a new variation for this set of walls. Unlock the stud and finish component and the frame wall will extend down to the foundation.
45. Save and close the project.





1 Basement Floor Plan
3/16" = 1'-0"

Green Inc	
Manor House	
Basement Floor Plan	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-2	
Scale	3/16" = 1'-0"



1 First Floor Plan
3/16" = 1'-0"

Green Inc
Manor House
First Floor Plan

Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker

A-3

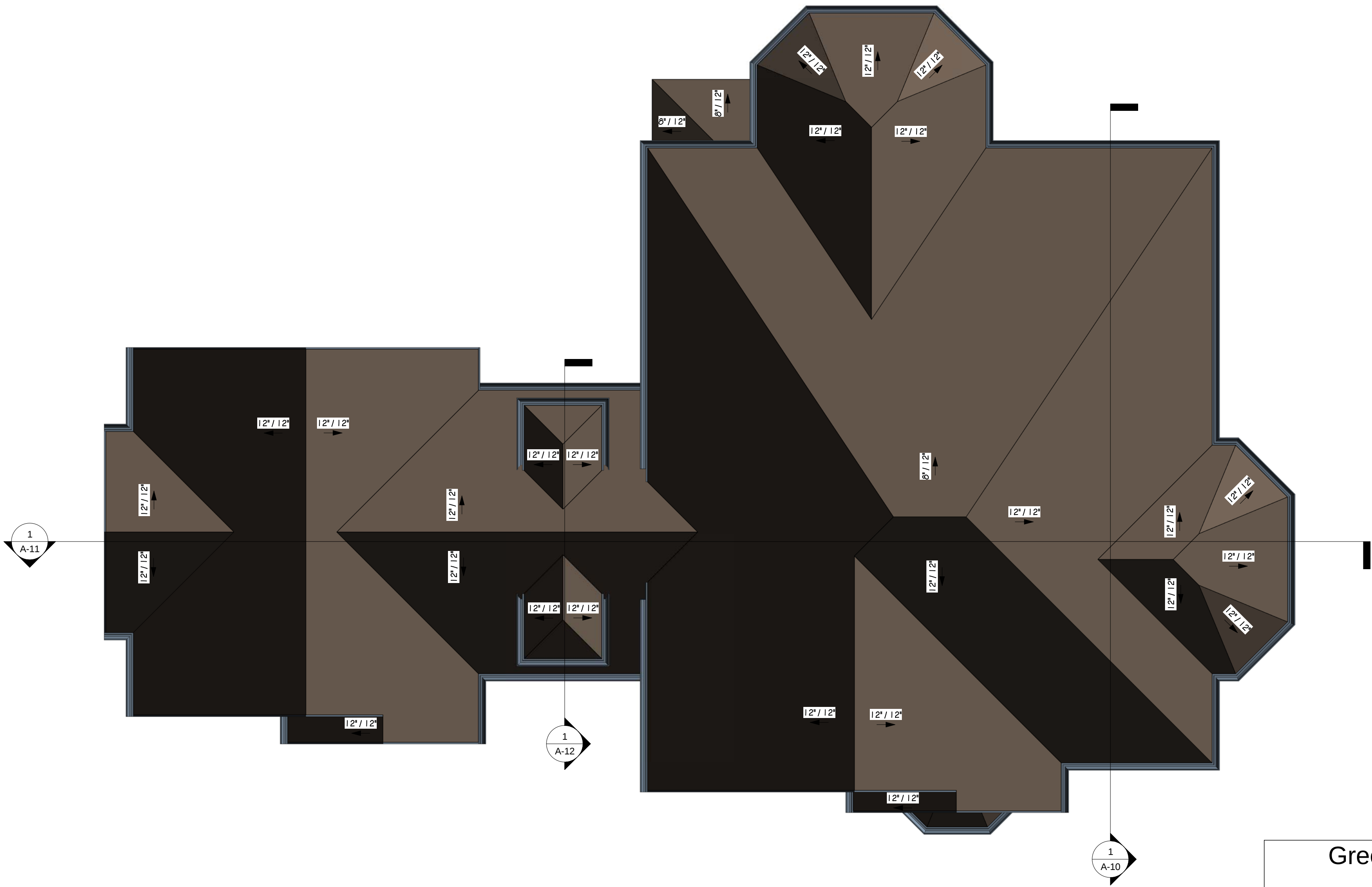
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26/06/2015 12:10:58 PM



① Second Floor Plan
3/16" = 1'-0"

Green Inc Manor House Second Floor Plan	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-4	
Scale	3/16" = 1'-0"



1 Roof Plan
3/16" = 1'-0"

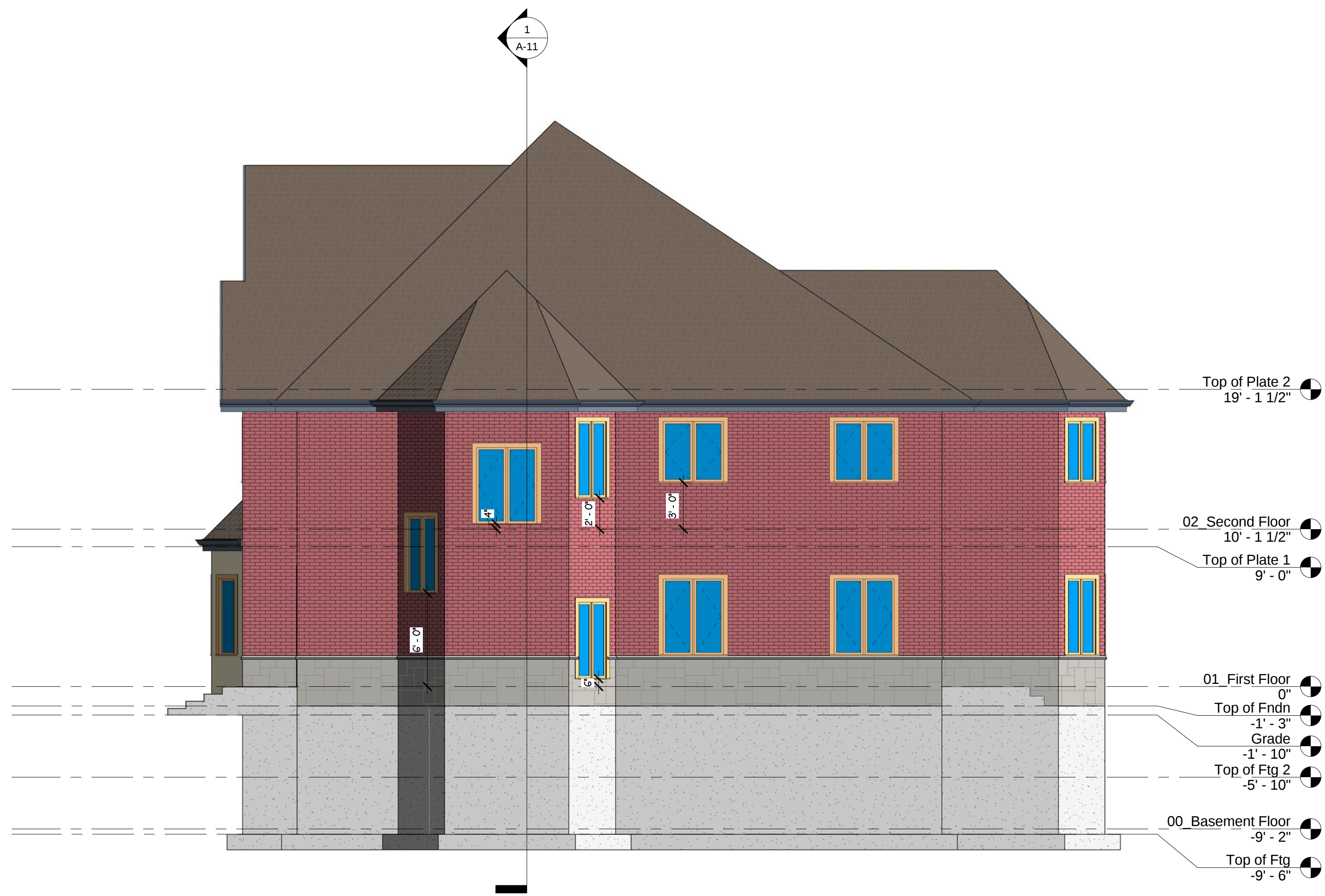
Green Inc	
Manor House	
Roof Plan	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-5	
Scale	3/16" = 1'-0"



① South Elevation
3/16" = 1'-0"

Green Inc	
Manor House	
South Elevation	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-6	
Scale	3/16" = 1'-0"

26/06/2015 12:11:04 PM



① East Elevation
3/16" = 1'-0"

Green Inc
Manor House
East Elevation

Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
	A-7
Scale	3/16" = 1'-0"

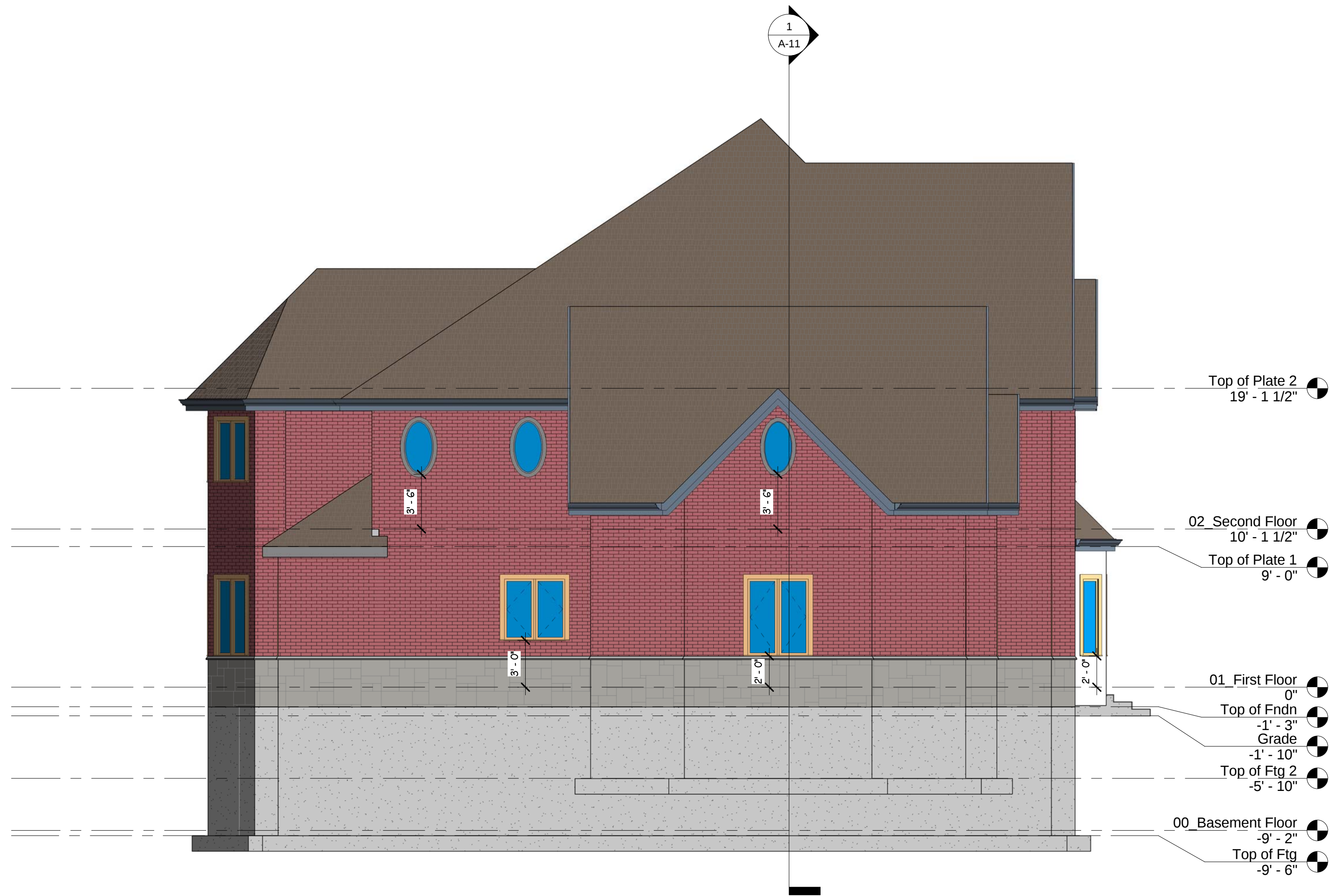
26/06/2015 12:11:06 PM



① North Elevation
3/16" = 1'-0"

Green Inc	
Manor House	
North Elevation	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-8	
Scale	3/16" = 1'-0"

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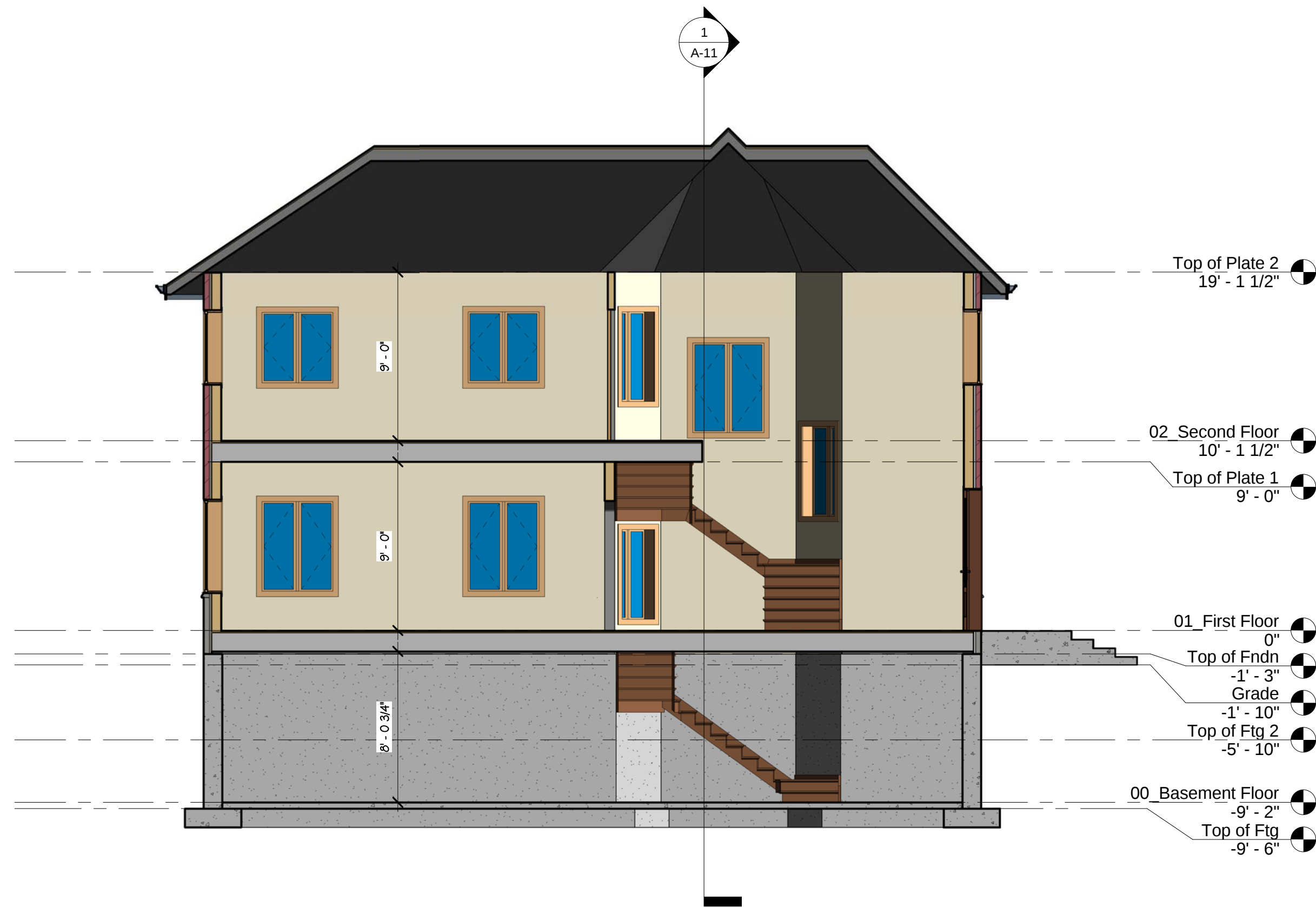


① West Elevation
3/16" = 1'-0"

Green Inc
Manor House
West Elevation

Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-9	
Scale	3/16" = 1'-0"

26/06/2015 12:11:11 PM



① Cross Section
3/16" = 1'-0"

Green Inc	
Manor House	
Cross Section	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-10	
Scale	3/16" = 1'-0"

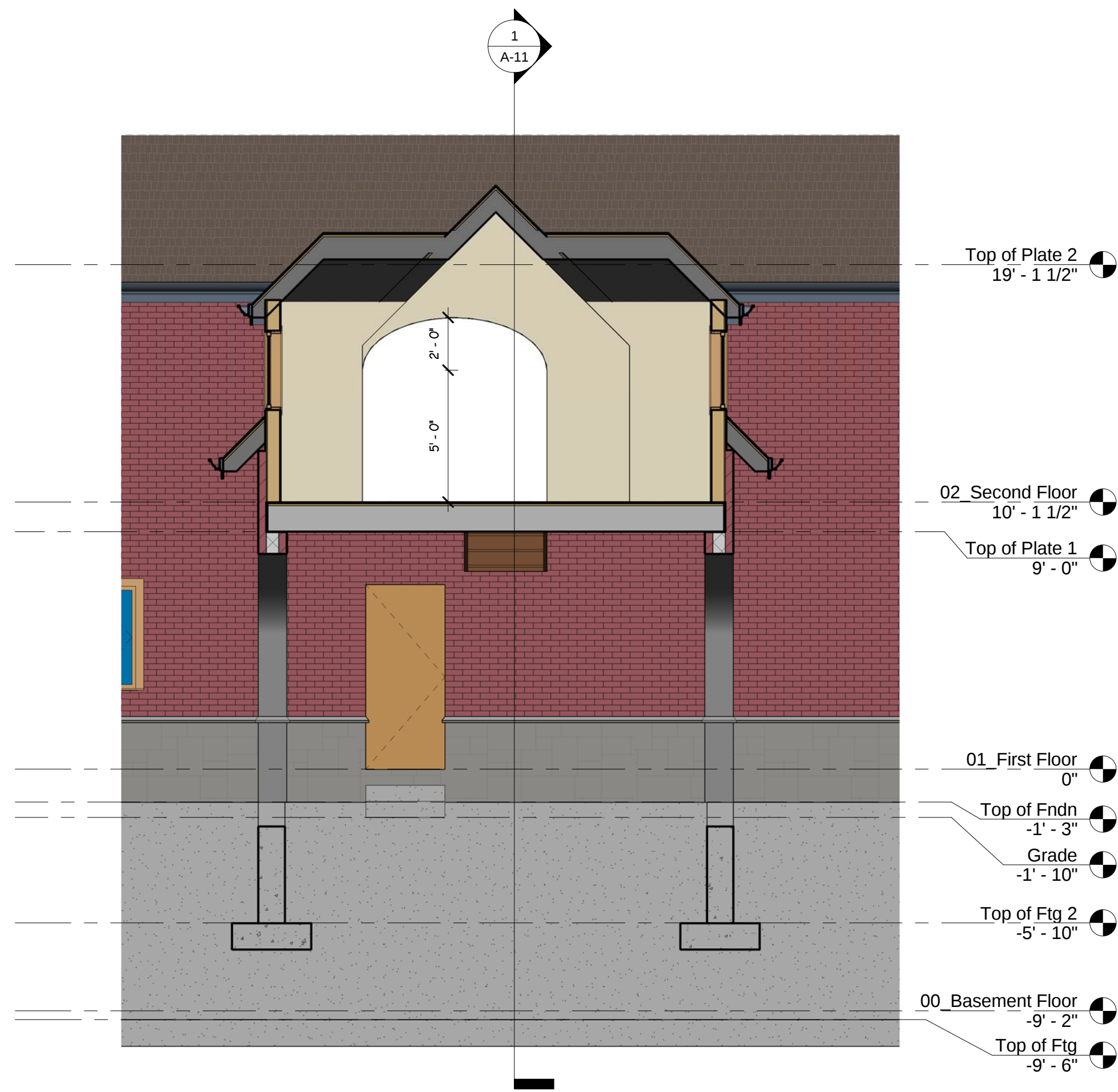
26/06/2015 12:11:13 PM



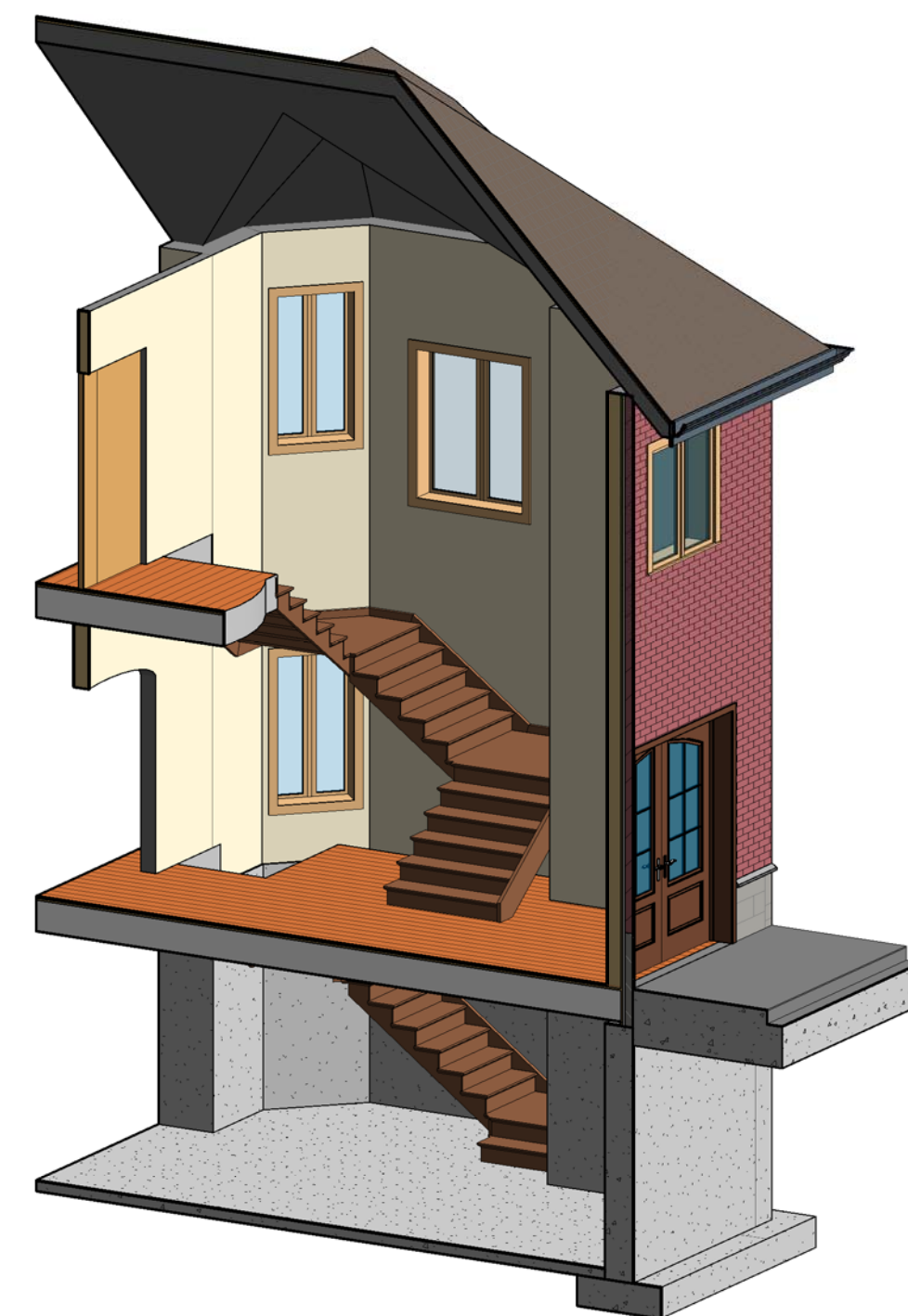
① Longitudinal Section
3/16" = 1'-0"

Green Inc	
Manor House	
Longitudinal Section	
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Drawn by	KB
Checked by	Checker
A-11	
Scale	3/16" = 1'-0"

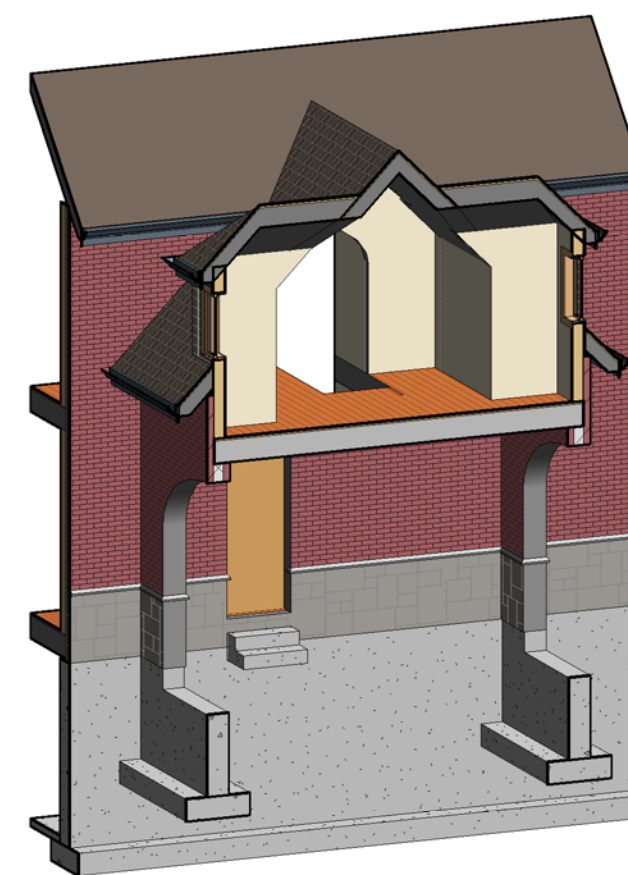
26/06/2015 12:11:15 PM



① Dormer Section
1/4" = 1'-0"



② 3D Entrance Stair



③ 3D Dormer Section

Green Inc	
Manor House	
Dormer Section and 3D Sections	
Project number	2015_001
Date	16/06/2015
Drawn by	KB
Checked by	Checker
A-12	
Scale	1/4" = 1'-0"

26/06/2015 12:11:17 PM